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(71)Applicant : SEIKO EPSON CORP

(72)Inventor : MORI YOSHIAKI
MIYAGAWA TAKUYA
ASANO YASUHIKO
KURASHINA OSAMU
YAMAZAKI YASUO
NAMIMA TOKUMASA
KURASHIMA YOHEI
ANAMI MAKOTO

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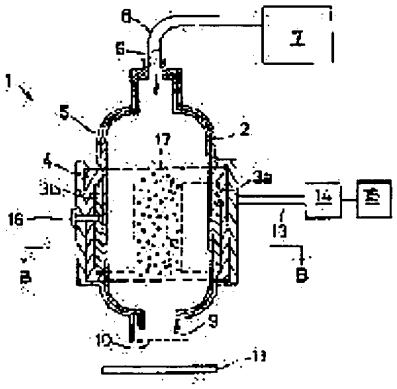
(54) METHOD AND DEVICE FOR SURFACE PROCESSING, METHOD AND DEVICE FOR MANUFACTURE OF SEMICONDUCTOR DEVICE, AND MANUFACTURE OF LIQUID CRYSTAL DISPLAY



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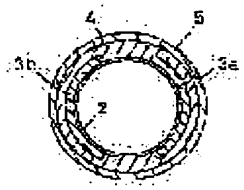

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(57)Abstract:

PURPOSE: To eliminate necessity for providing any decompressed environment, construct the device small and movable, allow the device to operate with a high processing ability and at low cost, give less damage to the material to be processed, and subject the material to a surface processing locally as applicable.

CONSTITUTION: A gas according to the purpose is introduced in a gas passage 2 formed from a dielectric material. A high frequency voltage is impressed, and within the gas passage the gas is allowed to conduct a gas discharge under the atmospheric pressure or with a certain pressure around it. The active seed of gas produced by this discharging is turned into a gas flow, to which a material to be processed 11 is exposed so that its surface undergoes the intended processing.

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CLAIMS

[Claim(s)]

[Claim 1] The surface treatment approach characterized by including the process which introduces predetermined gas in the gas passageway formed with dielectric materials, is made to produce gas discharge in said predetermined gas under atmospheric pressure or the pressure of the near within said gas passageway, is made to expose processed material to the active species of said gas generated by said discharge, and processes the front face.

[Claim 2] The surface treatment approach according to claim 1 characterized by producing said gas discharge by impressing high-frequency voltage to the electrode prepared in the outside of a gas passageway which consists of said dielectric materials.

[Claim 3] The surface treatment approach according to claim 1 characterized by producing said gas discharge by the electrodeless discharge by microwave.

[Claim 4] Claim 1 characterized by making it exposed to this active species thru/or claim 3 are the surface treatment approach of a publication either by applying the gas stream containing said active species, without making the front face of said processed material expose to said gas discharge directly.

[Claim 5] The surface treatment approach according to claim 4 characterized by arranging said processed material near the outlet of said gas passageway.

[Claim 6] The surface treatment approach according to claim 4 characterized by applying said gas stream to the front face of said processed material through the duct linked to the outlet of said gas passageway.

[Claim 7] Claim 4 characterized by applying said gas stream to the front face of said processed material through a metal mesh thru/or claim 6 are the surface treatment approach of a publication either.

[Claim 8] The surface treatment approach according to claim 7 characterized by producing said gas discharge between said electrodes by using said metal mesh as an earth electrode.

[Claim 9] Claim 1 characterized by making the front face of said processed material expose to the active species of said gas alternatively thru/or claim 8 are the surface treatment approach of a publication either.

[Claim 10] Claim 1 to which said predetermined gas is characterized by including rare gas at least at the time of initiation of said gas discharge thru/or claim 9 are the surface treatment approach of a publication either.

[Claim 11] Claim 1 characterized by said predetermined gas being either helium, nitrogen or the compressed air thru/or claim 10 are the surface treatment approach of a publication either.

[Claim 12] Claim 1 to which said predetermined gas is characterized by including helium or nitrogen, and oxygen thru/or claim 10 are the surface treatment approach of a publication either.

[Claim 13] Claim 1 to which said predetermined gas is characterized by including helium or the compressed air, and a fluorine compound thru/or claim 10 are the surface treatment approach of a publication either.

[Claim 14] Claim 1 characterized by for said predetermined gas consisting of 100% of rare gas, activating the reactant gas which exists near [said] processed material by said gas discharge, and making the front face of said processed material expose to the active species thru/or claim 9 are the surface treatment approach of a publication either.

[Claim 15] The surface treatment approach according to claim 14 that said reactant gas is characterized by being contained in the ambient atmosphere near [said] processed material.

[Claim 16] The surface treatment approach according to claim 14 characterized by introducing said reactant gas near [said] processed material.

[Claim 17] Claim 1 characterized by making said processed material expose to the gas which contains said active species under existence of moisture thru/or claim 16 are the surface treatment approach of a publication either.

[Claim 18] The surface treatment approach according to claim 17 characterized by making said processed material expose to said gas underwater.

[Claim 19] Claim 1 characterized by cooling or heating said processed material thru/or claim 18 are the surface treatment approach of a publication either.

[Claim 20] Claim 1 characterized by cooling the part of said gas passageway exposed

to said electrode for which high-frequency voltage is impressed and/or said discharge thru/or claim 19 are the surface treatment approach of a publication either.

[Claim 21] Claim 1 characterized by processing the front face while moving said processed material thru/or claim 20 are the surface treatment approach of a publication either.

[Claim 22] Surface treatment equipment characterized by consisting of a means to make said gas generate gas discharge under atmospheric pressure or the pressure of the near, and a means to make said processed material expose to the gas containing the active species generated by said discharge the gas passageway formed with dielectric materials, the means for introducing gas in said gas passageway, and within said gas passageway.

[Claim 23] Surface treatment equipment according to claim 22 characterized by said gas discharge generating means consisting of an electrode prepared in the outside of said gas passageway, and a means to impress high-frequency voltage to said electrode.

[Claim 24] Surface treatment equipment according to claim 23 with which said electrode is characterized by being relatively prepared in the outside of said gas passageway movable.

[Claim 25] Surface treatment equipment according to claim 22 with which said gas discharge generating means is characterized by generating the electrodeless discharge by microwave.

[Claim 26] Surface treatment equipment according to claim 23 or 24 with which said gas discharge generating means is characterized by having the grounded counter-electrode and carrying out gas discharge between said electrodes.

[Claim 27] Claim 22 characterized by said means to make said processed material expose becoming gas containing said active species from the outlet of said gas passageway which makes the gas stream of said gas blow off thru/or claim 26 are surface treatment equipment of a publication either.

[Claim 28] Surface treatment equipment according to claim 27 with which said means to make said processed material expose to the gas containing said active species is characterized by having the duct which guides said gas stream near [said] processed material from said outlet.

[Claim 29] Surface treatment equipment according to claim 27 or 28 with which said means to make said processed material expose to the gas containing said active species is characterized by having further the metal mesh arranged between said outlets and said processed material.

[Claim 30] Surface treatment equipment according to claim 29 characterized by grounding said metal mesh and generating gas discharge between said electrodes and said metal mesh.

[Claim 31] Claim 22 characterized by having further a mask means for making the front face of said processed material expose to the gas which contains said active species alternatively thru/or claim 30 are surface treatment equipment of a publication either.

[Claim 32] Claim 22 characterized by having further a means for introducing reactant gas near [said] processed material, and for said gas introduced in said gas passageway by said gas installation means consisting of 100% of rare gas, and activating said reactant gas by the gas discharge of said rare gas thru/or claim 31 are surface treatment equipment of a publication either.

[Claim 33] Claim 22 characterized by having further a means for including moisture in the gas containing said active species thru/or claim 32 are surface treatment equipment of a publication either.

[Claim 34] Claim 22 characterized by having further a means to supply moisture to the front face of said processed material made to expose to the gas containing said active species thru/or claim 32 are surface treatment equipment of a publication either.

[Claim 35] Claim 22 characterized by being underwater exposed to the gas which said processed material is arranged underwater and contains said active species thru/or claim 31 are surface treatment equipment of a publication either.

[Claim 36] Claim 22 characterized by having a means to cool or heat said processed material thru/or claim 35 are surface treatment equipment of a publication either.

[Claim 37] Claim 23 characterized by having a means to cool the part of said gas passageway exposed to said electrode for which high-frequency voltage is impressed and/or said discharge, claim 24, claim 26, or claim 36 is surface treatment equipment of a publication either.

[Claim 38] Claim 22 characterized by being relatively movable in a means to make the gas containing said active species expose, and said processed material thru/or claim 37 are surface treatment equipment of a publication either.

[Claim 39] Claim 23 characterized by connecting said electrode through the impedance etching circuit and coaxial cable which were connected to the power source of said high-frequency voltage when the frequency of the electrical potential difference impressed to said electrode is 13.56MHz or less, claim 24, claim 26, or claim 38 is surface treatment equipment of a publication either.

[Claim 40] [before carrying out the resin seal of said electronic parts and lead which joined electronic parts and a lead, are the approach of resin enclosing and manufacturing the semiconductor device of a package mold, and were joined] Introduce predetermined gas in the gas passageway formed with dielectric materials, and gas discharge is produced in said predetermined gas under atmospheric pressure or the pressure of the near within said gas passageway. The manufacture approach of the semiconductor device characterized by performing said electronic parts joined to the active species of said gas generated by said discharge, and the surface treatment process of a lead to which either is made to expose at least.

[Claim 41] The manufacture approach of the semiconductor device according to claim 40 characterized by performing said surface treatment process before carrying out a resin seal after said lead is an inner lead of a tape career and connects said electronic parts and said inner lead.

[Claim 42] It is the approach of joining electronic parts and a lead, and resin enclosing and manufacturing the semiconductor device of a package mold. Before joining said electronic parts and lead, predetermined gas is introduced in the gas passageway formed with dielectric materials. Gas discharge is produced in said predetermined gas under atmospheric pressure or the pressure of the near within said gas passageway. The manufacture approach of the semiconductor device characterized by performing said electronic parts joined to the active species of said gas generated by said discharge, and the surface treatment process of a lead to which either is made to expose at least.

[Claim 43] The manufacture approach of the semiconductor device according to claim 42 characterized by performing said surface treatment process before said lead is an inner lead of a tape career and connects said electronic parts and said inner lead.

[Claim 44] The surface treatment section for being equipment for resin enclosing the electronic parts and the lead which were joined and manufacturing the semiconductor device of a package mold, and carrying out surface treatment of said electronic parts and lead which were joined, The gas passageway in which it became from the resin seal section for resin to enclose said electronic parts and lead in which surface treatment was carried out by said surface treatment section, and said surface treatment section was formed with dielectric materials, The means for introducing gas in said gas passageway, and a means to make said gas generate gas discharge under atmospheric pressure or the pressure of the near within said gas passageway, The manufacturing installation of the semiconductor device

characterized by having said electronic parts joined to the gas containing the active species generated by said discharge, and a means of a lead to make either expose at least.

[Claim 45] It is equipment for joining electronic parts and a lead and manufacturing a semiconductor device. The surface treatment section for [of said electronic parts and a lead] carrying out surface treatment of either before the junction at least, The gas passageway in which it became from the bonding area for joining said electronic parts and lead, and said surface treatment section was formed with dielectric materials, The means for introducing gas in said gas passageway, and a means to make said gas generate gas discharge under atmospheric pressure or the pressure of the near within said gas passageway, The manufacturing installation of the semiconductor device characterized by having a means to make either [at least] said electronic parts or a lead expose to the gas containing the active species generated by said discharge.

[Claim 46] The manufacturing installation of the semiconductor device according to claim 45 with which said lead is an inner lead of a tape career, and said surface-preparation section is characterized by carrying out surface preparation of the inner lead of said tape career fed from a reel from said bonding area in this side.

[Claim 47] By connecting the circuit for the object for a drive, and power sources, and assembling a module, after sticking a polarizing plate on a liquid crystal cell Are the approach of manufacturing a liquid crystal display and predetermined gas is introduced in the gas passageway formed with dielectric materials. The manufacture approach of the liquid crystal module characterized by including the surface-preparation process which makes said substrate expose to the active species of said gas which is made to produce gas discharge in said predetermined gas under atmospheric pressure or the pressure of the near within said gas passageway, and is generated by said discharge.

[Claim 48] By connecting the circuit for the object for a drive, and power sources, and assembling a module, after sticking a polarizing plate on a liquid crystal cell Before being the approach of manufacturing a liquid crystal display and sticking a polarizing plate on said liquid crystal cell Introduce predetermined gas in the gas passageway formed with dielectric materials, and gas discharge is produced in said predetermined gas under atmospheric pressure or the pressure of the near within said gas passageway. The manufacture approach of the liquid crystal display characterized by performing the surface-preparation process which makes said liquid crystal cell expose to the active species of said gas generated by said discharge.

[Claim 49] After carrying two or more electronic parts, it is the manufacture approach of the semiconductor device which removes the electronic parts of a defective, and exchanges for the electronic parts of an excellent article and consists of a re-mounted process. Before connecting the electronic parts of the account excellent article of back to front which removed the electronic parts of said defective Introduce predetermined gas in the gas passageway formed with dielectric materials, and gas discharge is produced in said predetermined gas under atmospheric pressure or the pressure of the near within said gas passageway. The manufacture approach of the semiconductor device characterized by performing the electronic parts of said excellent article, and the surface treatment process of the connection of said semiconductor device to which either is made to expose at least to the active species of said gas generated by said discharge.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention is used for membrane formation on the front face of a semi-conductor etc., in order to carry out [in / for the front face of processed material / manufacture of a semiconductor device] the resin seal of the electronic parts as pretreatment or after treatment of a mounting process, concerning the etching or surface treatment technique which removes an inorganic substance and the organic substance, or reforms by carrying out ashing, and improves wettability.

[0002]

[Description of the Prior Art] Conventionally, various techniques for this kind of surface treatment are known with development of semiconductor technology. For example, in case electronic parts are mounted, there are a wet cleaning method by the organic solvent and a dry cleaning method which irradiate ozone, ultraviolet rays, etc., and the organic substance is made to produce a chemical reaction, and is removed as an approach of removing the organic substance like the flux used for soldering. However, while the facility fixed in order to perform the rinse process which removes a cleaning agent after washing of the organic substance, the process which dries a substrate, and these is required and the sentiment method took great time amount and a great effort, there was a problem that a manufacturing cost became high. Furthermore, in washing by the sentiment method, there is a possibility that a cleaning agent may affect electronic parts. Moreover, by the dry cleaning

method, since the removal capacity of the organic substance especially with large molecular weight is low, sufficient cleaning effect is not expectable.

[0003] For this reason, recently, the plasma is generated in a vacuum and the method of removing the organic substance and an inorganic substance using this is developed. For example, in case the plastic package of the IC chip is carried out, by processing the front face of a leadframe with the oxygen gas activated by microwave discharge under reduced pressure, the adhesion of a leadframe and resin is improved to JP,58-147143,A, and the method of raising dependability is indicated. Moreover, by the surface mount approach of the electronic parts indicated by JP,4-116837,A, the oxide is removed by introducing the hydrogen gas of 1 - 10Torr into a plasma etching system, and discharging. Furthermore, high-frequency voltage is impressed to an electrode in the decompressed processing interior of a room, and the approach of etching a leadframe is indicated by JP,5-160170,A by generating the argon oxygen plasma or the hydrogen reduction plasma.

[0004] Moreover, it is known by using rare gas and slight reactant gas under atmospheric pressure, and generating the plasma that plasma CVD, ashing, etching, and surface treatment are possible. In many cases, these generate discharge between an RF electrode and processed material. As a thing it was made to make discharge by the power-source electrode and touch-down inter-electrode, on the other hand, to JP,3-133125,A Atmospheric pressure discharge of the gas containing a **** ghost is carried out, and the approach of carrying out ashing by spraying a substrate or being exposed under an ozone ambient atmosphere is indicated. To JP,4-145139,A By carrying out plasma electrodischarge treatment of the front face of a fluorine system member with atmospheric pressure to the bottom of a gaseous helium ambient atmosphere, hydrophilization of the front face is carried out and the approach of reforming on the front face suitable for adhesion is indicated.

[0005]

[Problem(s) to be Solved by the Invention] However , in the surface treatment technique using the conventional plasma discharge mentioned above , the special facility of a vacuum chamber , a vacuum pump , etc. be required , therefore having enlarge and complicate the whole equipment , and moreover , an activity and local processing in a site having un-arrange [that it be difficult] , while it be expensive and cost went up , when make it discharge under the environment decompressed like JP,58-147143,A or JP,4-116837,A . Moreover, since the processings themselves -- it is necessary to decompress the inside of a chamber to a predetermined pressure, and to maintain it in the case of discharge, and can process only about twice in 1

hour -- took long duration, there was a problem that a throughput is comparatively [with a troublesome activity] low, and it could not carry out [in-line]-izing since sheet processing is difficult although batch processing is possible. Furthermore, in the plasma discharge in a vacuum or under reduced pressure, since there are much electron and ion, when it uses especially for the surface preparation of a semiconductor device as compared with an excitation kind, the damage to electronic parts becomes large.

[0006] On the other hand, although the approach of carrying out plasma discharge under atmospheric pressure is advantageous at the point which does not need a vacuum facility, a discharge condition tends to become an ununiformity, and some which generate discharge between an electrode and processed material have a possibility of making processed material producing a damage, therefore the distance between an electrode and processed material, the quality of the material of processed material, etc. will be restrict. Corresponding to [when irregularity is large in the configuration of processed material being complicated] it, there was a problem of fully being unable to process especially the part that, and arose in [discharge] localization or was dented. [the part] [that the configuration of an electrode becomes complicated]

[0007] Even when making it discharge by inter-electrode, the approach of JP,3-133125,A is for removing a resist from the substrate after patterning, since it arranges in a quartz cell in order to put processed material to excitation gas, processing is troublesome and in-line-izing and processing in a site are difficult. Moreover, it is not suitable for local ashing or local etching, and when a defect chip is removed from the case where the resin seal especially of the electronic parts is carried out, or a semiconductor device and it re-mounts an excellent article, surface treatment cannot be carried out in practice. Moreover, in atmospheric pressure plasma discharge of JP,4-145139,A, processed material is held in the processing interior of a room which the electrode was made to counter, in order to carry out the firm gas of the expensive gaseous helium and to process it, great cost starts and equipment is enlarged. For this reason, while in-line-izing is difficult, it is not suitable for an activity [in local electrodischarge treatment or a local site]. Moreover, since the electrode is arranged in the processing interior of a room which generates discharge, it is easy to receive damage by discharge, and easy to produce a problem in endurance.

[0008] Then, the place which the surface treatment approach of this invention is made in view of the conventional trouble mentioned above, and is made into the

purpose The facility for a vacuum or reduced pressure is not needed, but equipment can be constituted easily and it can miniaturize. Without being under atmospheric pressure or the pressure of the near, and giving a thermal or electric damage to processed material irrespective of the configuration and quality of the material safely While being able to carry out surface treatment of ashing, etching, dry washing, or a wettability improvement and being able to process processed material locally, in-line-izing and use in a site are possible, and it is in offering the surface treatment approach that a throughput is high, by low cost. Furthermore, the purpose of this invention is to offer the surface treatment equipment for realizing the surface treatment approach mentioned above.

[0009] Moreover, another purpose of this invention is set to manufacture of the semiconductor device package-ized by connecting electronic parts and a lead and enclosing these by resin. While the junction nature of electronic parts and a lead can be raised, and the wettability of these and resin is raised and adhesion is raised, and raising the yield and being able to manufacture a reliable package mold semiconductor device It has a throughput with them, and is in offering the approach and equipment in which sheet processing and in-line-izing are possible. [there are few damages / as opposed to / the comparatively easy configuration which does not need a reduced pressure environment can realize these by low cost, and the miniaturization of equipment is possible, and / electronic parts moreover /, and high]

[0010] In ILB (inner lead bonding) which connects IC chip to a tape career especially, by the conventional wet cleaning method, since it is comparatively troublesome to remove the dirt adhering to an inner lead front face or a chip plane of composition, generally the process defecated before joining these is not performed. Moreover, the coat of polyimide resin may remain in the tape career. For this reason, when an inner lead and IC chip were not able to join good and a resin seal was carried out at a back process, adhesion with mold resin was bad and was set to one of the causes to which the yield is reduced. Then, in ILB, it is to offer the manufacture approach of a semiconductor device and equipment which can carry out [in-line]-izing of this surface preparation easily while still more nearly another purpose of this invention can carry out surface preparation of a tape career and the IC chip by low cost easily, and can raise the junction nature of an inner lead and IC chip by that cause, and can raise adhesion with mold resin and can raise the yield.

[0011] Moreover, in manufacture of a semiconductor device, when the electronic parts of a defective were removed and the electronic parts of an excellent article were remounted after mounting two or more electronic parts, since partial surface

treatment was difficult, all the electronic parts carried were removed, it re-mounted and great time and effort and cost had been required conventionally. Then, the manufacture approach of the semiconductor device of this invention carries out surface treatment only of the re-joined part. Dirt, such as adhesives, wax material, etc. which remains locally, is removed certainly and simply, without affecting the electronic parts carried in other parts. Wettability is raised to coincidence, the electronic parts of an excellent article can be connected good, moreover processing speed is suitable for processing in early and a site, and it aims at offering the approach of reducing time and effort and cost sharply.

[0012] Furthermore, in manufacture of a liquid crystal display, in order to eliminate the dust which causes the display defect which is the biggest technical problem, washing processing is performed several times into the production process. Wet washing by the detergent and dry washing of UV-ozone washing etc. are carried out to the washing approach. Moreover, dry washing by the oxygen plasma discharge in the vacuum mentioned above is also adopted from a viewpoint of the environmental protection at the time of using an organic solvent. However, as mentioned above, the problem on the structure of equipment and cost to sheet processing is difficult for processing in a vacuum environment, except for the case where it is a large-sized panel, batch processing of hundreds of sheet unit is usually performed, and, moreover, the whole panel surface is always processed. Moreover, since processing number of sheets is once determined in consideration of a back process including the problem of pot life, a production control is difficult and it is difficult by only making [many] processing number of sheets to decrease cost. Then, equipment can be miniaturized by low cost, while sheet processing is possible for processing speed and it can realize in-line-ization with a back process by that cause early, flexibility can be given to a production control, and still more nearly another purpose of this invention has washing processing in comparatively easy and offering the approach of moreover processing on the spot.

[0013] Moreover, in case a polarizing plate is stuck on a liquid crystal cell, pretreatment which removes the dirt by the remnants of the flux which dispersed at the time of patterning of a substrate, or a scribe, and the fingerprint etc. from a liquid crystal cell front face is required. The effect which the solvent after washing has on an environment although these processings were conventionally washed using the chlorine-based solvent is large, therefore although the approach of rubbing dirt off mechanically manually on a cutter or a cleaning tape is common, there is a possibility of giving a physical damage to a liquid crystal panel. Moreover, cost becomes high

although there is also a method of covering the liquid crystal panel with the protection film beforehand, removing this, and sticking a polarizing plate. Then, in pretreatment for sticking a polarizing plate on a liquid crystal panel, a throughput is high at low cost and another purpose of this invention is to offer [comparatively easy and] the approach which a possibility of giving a physical damage to a liquid crystal panel twists.

[0014]

[Means for Solving the Problem] This invention is for attaining the purpose mentioned above, and is explained using the example which showed the contents to the drawing below.

[0015] The surface treatment approach according to claim 1 is characterized by introducing predetermined gas in the gas passageway formed with dielectric materials, producing gas discharge in gas predetermined [in a gas passageway] in the bottom of atmospheric pressure or the pressure of that near, making processed material expose to the active species of the gas generated by this discharge, and processing that front face.

[0016] By impressing high-frequency voltage to the electrode prepared in the outside of a gas passageway which consists of dielectric materials in addition to the focus of claim 1 mentioned above, the surface treatment approach according to claim 2 is characterized by producing gas discharge, on the other hand is characterized by an approach according to claim 3 producing gas discharge by the electrodeless discharge by microwave.

[0017] Moreover, the surface treatment approach according to claim 4 is characterized by making it exposed by applying the gas stream containing active species rather than making the front face of processed material expose to gas discharge directly. For this reason, it is characterized by an approach according to claim 5 arranging processed material near the outlet of a gas passageway, and an approach according to claim 6 is characterized by applying a gas stream to the front face of processed material through the duct linked to the outlet of a gas passageway.

[0018] In addition to these, it is characterized by the surface treatment approach according to claim 7 applying a gas stream to the front face of processed material through a metal mesh, and an approach according to claim 8 is further characterized by producing gas discharge by using this metal mesh as an earth electrode.

[0019] Moreover, the surface treatment approach according to claim 9 is characterized by choosing the front face of processed material and making it partially exposed to gas active species.

[0020] The surface treatment approach according to claim 10 is characterized by predetermined gas containing rare gas at least at the time of initiation of gas discharge.

[0021] An approach according to claim 12 is characterized by predetermined gas containing helium or nitrogen, and oxygen to predetermined gas being characterized by being either helium, nitrogen or the compressed air, as for the surface treatment approach according to claim 11, and an approach according to claim 13 is characterized by predetermined gas containing helium or the compressed air, and a fluorine compound.

[0022] Moreover, predetermined gas consists of 100% of rare gas, and the surface treatment approach according to claim 14 activates the reactant gas which exists near processed material by gas discharge, and is characterized by making a processed material front face expose to the active species.

[0023] In addition, the surface treatment approach according to claim 15 is characterized by containing reactant gas in the ambient atmosphere near processed material, and the surface treatment approach according to claim 16 is characterized by introducing reactant gas near processed material compulsorily.

[0024] The surface treatment approach according to claim 17 is characterized by making processed material expose to the gas which contains active species under existence of moisture, and the surface treatment approach according to claim 18 is characterized by making processed material expose to a gas stream in underwater.

[0025] The surface treatment approach according to claim 19 is characterized by cooling or heating processed material.

[0026] The surface treatment approach according to claim 20 is characterized by cooling the part of a gas passageway exposed to the electrode and/or discharge which impress high-frequency voltage.

[0027] The surface treatment approach according to claim 21 is characterized by processing continuously the part from which the front face differs, moving processed material.

[0028] According to another side face of this invention, surface treatment equipment according to claim 22 is characterized by consisting of a means to make gas generate gas discharge under atmospheric pressure or the pressure of the near, and a means to make processed material expose to the gas containing the active species generated by discharge the gas passageway formed with dielectric materials, the means for introducing gas in a gas passageway, and within a gas passageway.

[0029] Surface treatment equipment according to claim 23 is characterized by a gas

discharge generating means consisting of an electrode prepared in the outside of a gas passageway, and a means to impress high-frequency voltage to an electrode in addition to the focus of claim 22 mentioned above, in addition equipment according to claim 24 is characterized by preparing an electrode in the outside of a gas passageway movable relatively.

[0030] Moreover, in addition to the focus of claim 22 mentioned above, surface treatment equipment according to claim 25 is characterized by generating the electrodeless discharge by microwave with a gas discharge generating means.

[0031] It is characterized by carrying out gas discharge of the surface treatment equipment according to claim 26 between the electrodes which a gas discharge generating means has the grounded counter-electrode, and prepared in the outside of a gas passageway.

[0032] Surface treatment equipment according to claim 27 is characterized by consisting of an outlet of a gas passageway where a means to make processed material expose to the gas containing active species makes this gas blow off as a gas stream, and equipment according to claim 28 is characterized by having further a duct for guiding a gas stream from the outlet of a gas passageway to near processed material.

[0033] Moreover, it is characterized by surface treatment equipment according to claim 29 having the metal mesh by which a means to make processed material expose to the gas containing active species was arranged between the outlet of a gas passageway, and processed material, in addition a metal mesh is grounded and equipment according to claim 30 is characterized by carrying out gas discharge between this metal mesh and electrode.

[0034] Surface treatment equipment according to claim 31 is characterized by having further a mask means to make the front face of processed material expose to the gas which contains active species alternatively.

[0035] The gas which has further a means for introducing reactant gas near processed material, and is introduced in a gas passageway by the gas installation means is 100% of rare gas, and surface treatment equipment according to claim 32 is characterized by making it activate reactant gas by the gas discharge of rare gas.

[0036] Moreover, surface treatment equipment according to claim 33 is characterized by having further a means to include moisture in the gas containing active species, and surface treatment equipment according to claim 34 is characterized by having further a means to supply moisture to a processed material front face.

[0037] It is characterized by for surface treatment equipment according to claim 35 arranging processed material underwater, and exposing it to the gas containing active species underwater.

[0038] Surface treatment equipment according to claim 36 is characterized by having a means to cool or heat processed material, and surface treatment equipment according to claim 37 is characterized by having a means to cool the part of a gas passageway exposed to the electrode and/or discharge which impress high-frequency voltage.

[0039] Surface treatment equipment according to claim 38 is characterized by being relatively movable in the means and processed material to which the gas containing active species is made to expose.

[0040] Surface treatment equipment according to claim 39 is characterized by connecting this electrode through the impedance etching circuit and coaxial cable which were connected to the power source of high-frequency voltage, when the frequency of the electrical potential difference impressed to an electrode is 13.56MHz or less.

[0041] By using the surface treatment technique mentioned above according to this invention, moreover, the manufacture approach of a semiconductor device according to claim 40 When electronic parts and a lead are joined, resin encloses and it manufactures the semiconductor device of a package mold Introduce predetermined gas in the gas passageway formed with dielectric materials, and gas discharge is produced within a gas passageway in gas predetermined in the bottom of atmospheric pressure or the pressure of the near. It is characterized by carrying out, before carrying out the resin seal of the electronic parts and the lead which were joined in the electronic parts joined to the active species of the gas generated by this discharge, and the surface treatment process of a lead to which either is made to expose at least.

[0042] Before carrying out the resin seal of it after the manufacture approach of a semiconductor device according to claim 41 connects these in addition to this, when connecting electronic parts and the inner lead of a tape career, it is characterized by performing a surface treatment process.

[0043] Moreover, the manufacture approach of a semiconductor device according to claim 42 [when electronic parts and a lead are joined similarly, resin encloses and it manufactures the semiconductor device of a package mold] Before joining electronic parts and a lead, predetermined gas is introduced in the gas passageway formed with dielectric materials. Gas discharge is produced in said predetermined gas under

atmospheric pressure or the pressure of the near within said gas passageway, and it is characterized by performing said electronic parts joined to the active species of said gas generated by said discharge, and the surface treatment process of a lead to which either is made to expose at least.

[0044] When connecting electronic parts and the inner lead of a tape career, before the manufacture approach of a semiconductor device according to claim 43 connects these in addition to this, it is characterized by performing a surface treatment process.

[0045] In order that the manufacturing installation of a semiconductor device according to claim 44 may enclose the electronic parts and the lead which were joined by resin and may manufacture the semiconductor device of a package mold The surface treatment section for carrying out surface treatment of the electronic parts and the lead which were joined, The gas passageway in which it consisted of the resin seal sections for resin to enclose the electronic parts and the lead in which surface treatment was carried out by the surface treatment section, and the surface treatment section was formed with dielectric materials, The means for introducing gas in this gas passageway, and a means to generate gas discharge under atmospheric pressure or the pressure of that near within a gas passageway, It is characterized by having the electronic parts joined to the gas containing the active species generated by this discharge, and a means of a lead to make either expose at least.

[0046] The surface treatment section for [of the electronic parts which are going to join the manufacturing installation of a semiconductor device according to claim 45 and a lead] carrying out surface treatment of either before the junction at least, The gas passageway in which it consisted of bonding areas for joining electronic parts and a lead, and the surface treatment section was formed with dielectric materials, It is characterized by having a means to make said gas generate gas discharge under atmospheric pressure or the pressure of the near, and a means to make either [at least] electronic parts or a lead expose to the gas containing the active species generated by discharge the means for introducing gas in a gas passageway, and within a gas passageway.

[0047] In addition to this, the manufacturing installation of a semiconductor device according to claim 46 is characterized by the surface-preparation section carrying out surface preparation of the inner lead of the tape career fed from a reel from a bonding area in this side, when connecting electronic parts and the inner lead of a tape career.

[0048] The manufacture approach of a liquid crystal display according to claim 47 In the production process which connects the circuit for the object for a drive, and power sources, and assembles a module after sticking a polarizing plate on a liquid crystal cell Predetermined gas is introduced in the gas passageway formed with dielectric materials, gas discharge is produced in gas predetermined [in a gas passageway] in the bottom of atmospheric pressure or the pressure of that near, and it is characterized by including the surface treatment process which makes a substrate expose to the gas active species generated by this discharge.

[0049] On the other hand, the manufacture approach of a liquid crystal display according to claim 48 In the production process which similarly connects the circuit for the object for a drive, and power sources, and assembles a module after sticking a polarizing plate on a liquid crystal cell Before sticking a polarizing plate on a liquid crystal cell, predetermined gas is introduced in the gas passageway formed with dielectric materials. Gas discharge is produced in said predetermined gas under atmospheric pressure or the pressure of that near within a gas passageway, and it is characterized by performing the surface treatment process which makes a liquid crystal cell expose to the gas active species generated by this discharge.

[0050] In manufacture of the semiconductor device with which the manufacture approach of a semiconductor device according to claim 49 carried two or more electronic parts It is the approach of removing the electronic parts of a defective, and exchanging and re-mounting in the electronic parts of an excellent article. After removing a defective, predetermined gas is introduced in the gas passageway formed with dielectric materials. Gas discharge is produced in gas predetermined [in a gas passageway] in the bottom of atmospheric pressure or the pressure of the near. It is characterized by performing the surface treatment process of the connection of the semiconductor device which removed the electronic parts of an excellent article, and a defective to which either is made to expose at least to the gas active species generated by this discharge, and connecting the electronic parts of an excellent article to it after that.

[0051]

[Function] Therefore, since the plasma state is generated by introducing gas under the pressure near atmospheric pressure, and making it discharge within a gas passageway according to the surface treatment approach according to claim 1 Do not need a large-sized facility like vacuum devices, but handling and processing of introductory gas or processed material are comparatively easy. Equipment can be miniaturized so that it may be movable, according to the class of introductory gas to

be used, the front face of processed material can be washed, it can etch, and ashing can be carried out, or it can reform, and surface treatment of making wettability improve etc. can be carried out. And there is little thermal effect which it has on processed material since discharge does not have a direct line crack between processed material, and since the gas containing active species is irradiated at processed material, the electron and ion which are generated by discharge can collide with the molecule in atmospheric air, and can disappear the energy, and the damage to processed material decreases more and can raise processing speed.

[0052] According to the surface treatment approach according to claim 2, the damage of processed material can be lessened more more uniformly [discharge] by preparing in the outside of a gas passageway by being able to prevent damage on the electrode by discharge, and using an RF generator. Moreover, according to the surface treatment approach according to claim 3, the plasma state can be easily caused in introductory gas under atmospheric pressure by microwave discharge.

[0053] Also when according to the surface-preparation approach according to claim 4 the damage of processed material can be lessened more and processed material moreover has a complicated configuration and big irregularity, required surface preparation can be performed effectively and certainly to all the parts of processed material by applying the gas stream containing active species. Here, since the introductory gas containing gas active species flows out of the outlet of a gas passageway according to the approach according to claim 5, the front face of the processed material simply arranged under atmospheric pressure can be made to expose, according to the configuration and magnitude of for example, processed material, or a configuration, a location, area, etc. of a part which should be processed, a gas port can be formed or two or more configurations of this outlet can be established. Moreover, according to the approach according to claim 6, by preparing a duct from the outlet of a gas passageway, surface treatment of the processed material can be carried out in the location isolated from the gas passageway, and workability can be raised.

[0054] Since according to the surface treatment approach according to claim 7 the trap of this can be carried out by the metal mesh even if the charge generated by gas discharge is included in the gas stream, the damage of processed material can be canceled more certainly. Furthermore, according to the surface treatment approach according to claim 8, by making a metal mesh discharge as an earth electrode, the plasma state is produced by processed material in a near location, and surface treatment can be performed more effectively.

[0055] According to the surface-preparation approach according to claim 9, surface preparation of the processed material can be carried out, without giving effect and a damage locally to other parts if needed.

[0056] According to the surface treatment approach according to claim 10, the gas discharge under atmospheric pressure can be more easily generated by existence of rare gas.

[0057] When according to the surface treatment approach according to claim 11 introductory gas is suitably chosen according to the purpose and cost performance of surface treatment, helium was used as the base, improvement in wettability, etching, and ashing are performed with high processing speed, and nitrogen is used as the base or the compressed air is used, improvement in wettability and ashing can be performed comparatively cheaply.

[0058] According to the surface treatment approach according to claim 12, ashing of the processed material can be carried out comparatively cheaply and effectively by adjusting an oxygen density suitably, or wettability can be raised, and according to the surface treatment approach according to claim 13, processed material can be etched comparatively cheaply and effectively by existence of a fluorine compound.

[0059] According to the surface treatment approach according to claim 14, generating of the gas discharge under an atmospheric pressure is made easy by existence of rare gas, energy exchange with the radical kind which this produces generates the active species of the reactant gas near processed material, and even if this reactant gas cannot make it discharge under an atmospheric pressure easily, desired surface treatment can be carried out. Here, since the ambient atmosphere near processed material is used as reactant gas according to the surface treatment approach according to claim 15, it can be used for surface treatment cheaply and easily, and according to the approach according to claim 16, the reactant gas corresponding to the purpose can be supplied only near processed material, and can carry out surface treatment effectively.

[0060] According to the surface treatment approach according to claim 17, the processing speed can be brought forward by applying moisture and carrying out surface treatment of the processed material. Especially, according to the surface-preparation approach according to claim 18, wet washing or etching can be attained, and the gas which uses it near the processed material can remove static electricity as an environment of only O3 (ozone), or it can etch more effectively as an environment of only HF.

[0061] according to the surface treatment approach according to claim 19 -- the

description of processed material -- processed material can be cooled according to - quality of the material, a situation, the purpose of surface treatment, etc., and it can protect from the high temperature of discharge, or it can heat, and processing speed can be brought forward. Moreover, according to the surface treatment approach according to claim 20, the gas passageway which consists of dielectric materials can be protected from the high temperature by discharge. Furthermore, according to the surface treatment approach according to claim 21, corresponding to the dimension and configuration of processed material, a location, magnitude of a part which should be processed, etc., surface treatment can be carried out flexibly and efficiently, and surface treatment can be carried out one by one, moving two or more processed material.

[0062] According to surface treatment equipment according to claim 22, by the comparatively easy configuration which does not need the processing room in which vacuum devices and processed material are held By miniaturizing the whole equipment, and also being able to constitute movable in a site, and carrying out surface treatment of the processed material arranged under atmospheric pressure by the discharge generated under the pressure near the atmospheric pressure within the gas passageway The damage which is a high speed and is given to processed material can be lessened, and dry washing, etching, ashing, or wettability can be improved.

[0063] According to surface treatment equipment according to claim 23, an electrode by not receiving damage by discharge and using an RF generator by having been arranged in the outside of a gas passageway Uniform discharge and damage reduction of processed material can be aimed at, further, according to equipment according to claim 24, the location of the discharge field in a gas passageway can be changed, and the conditions of discharge generating can be easily adjusted corresponding to processed material.

[0064] According to surface treatment equipment according to claim 25, the plasma state can be easily caused in introductory gas under atmospheric pressure by microwave discharge.

[0065] According to surface treatment equipment according to claim 26, a possibility of producing direct discharge between a power-source electrode and processed material is lost, and the damage of processed material can be lessened more.

[0066] According to surface treatment equipment according to claim 27, even if it is the case where it has the configuration with a complicated front face and the big irregularity of processed material by sending in the active species by discharge

compulsorily as a gas stream, surface treatment can be carried out certainly and effectively to all parts, and the outlet of a gas passageway can also be formed according to the configuration of processed material, or the location and magnitude of a part which should be processed. Furthermore, according to surface treatment equipment according to claim 28, surface treatment can be carried out in the location isolated through the duct from the gas passageway, and workability can be raised.

[0067] According to surface treatment equipment according to claim 29, when a metal mesh carries out the trap of the electron and ion which are generated by discharge, it can remove from the gas stream containing active species effectively, and the damage of processed material can be canceled.

[0068] According to surface treatment equipment according to claim 30, active species can be more effectively irradiated at processed material by making it discharge by processed material by using a metal mesh as an earth electrode in a near location.

[0069] According to surface treatment equipment according to claim 31, surface treatment of the processed material can be easily carried out locally with a mask means, without giving effect and a damage to other parts.

[0070] According to surface treatment equipment according to claim 32, gas discharge is easily generated under atmospheric pressure by existence of rare gas, and under atmospheric pressure, the reactant gas supplied near processed material using this active species can be more easily made into the plasma state, even if it is gas which is hard to make it discharge.

[0071] According to claim 33 publication or surface treatment equipment according to claim 34, in case processed material is exposed to gas active species, a surface treatment rate can be brought forward by applying moisture.

[0072] According to surface-preparation equipment according to claim 35, wet washing or etching is performed, and the gas which uses it near the processed material can remove static electricity as an environment of only O3 (ozone), or it can etch more effectively as an environment of only HF.

[0073] According to surface treatment equipment according to claim 36, processed material can be cooled if needed, and it can protect from the high temperature of discharge, or it can heat, and processing speed can be brought forward, and the gas passageway which consists of dielectric materials according to equipment according to claim 37 can be protected from the high temperature by discharge, and the endurance of equipment can be raised.

[0074] According to surface treatment equipment according to claim 38, by moving

processed material relatively, according to the dimension of processed material, a configuration, or the purpose of processing, all the parts can be chosen uniformly or partially, and can be processed, and it can process, carrying out sequential migration of further two or more processed material.

[0075] According to surface-preparation equipment according to claim 39, it can carry out by connecting an electrode and an impedance-matching circuit through a coaxial cable that it is easy to move equipment.

[0076] It is comparatively simply high-speed, and the organic substance and the inorganic substance which reformed the front face of electronic parts, a lead, or these both sides by low cost, and adhered to these can be removed, wettability with the resin for closing can be raised, and it can be made to stick good by carrying out surface treatment by the gas containing the active species generated by gas discharge under the pressure near the atmospheric pressure according to the manufacture approach of a semiconductor device according to claim 40. Furthermore, according to the manufacture approach of a semiconductor device according to claim 41, the resin which encloses this also in ILB (inner lead bonding) which connects electronic parts and a tape career can be stuck good.

[0077] According to the manufacture approach of a semiconductor device according to claim 42, the organic substance and an inorganic substance can be removed by low cost comparatively easily from each plane of composition of electronic parts and a lead, and wettability can be raised, and by it, while it is joinable good, in case the resin seal of these is carried out in a back process, adhesion with resin can be raised. Furthermore, according to the manufacture approach according to claim 43, a good junction condition can be acquired also in the ILB process of electronic parts and a tape career.

[0078] According to the manufacturing installation of a semiconductor device according to claim 44, by the comparatively easy configuration which does not need vacuum devices etc., since the whole equipment can be miniaturized and surface treatment can be carried out easily [in atmospheric air] moreover at high speed, in-line-ization with the resin seal process of electronic parts can be attained easily.

[0079] according to the manufacturing installation of a semiconductor device according to claim 45 -- a comparatively easy configuration -- and by low cost, the organic substance and an inorganic substance can be removed from each plane of composition of electronic parts and a lead, and wettability can be raised, these can be joined good, and in order to process in atmospheric air moreover, in-line-ization becomes easy. And according to the manufacturing installation according to claim 46,

also in the ILB process of electronic parts and a tape career, in case a good junction condition can be acquired and a resin seal is carried out at a back process, adhesion with resin can be raised.

[0080] According to the manufacture approach of a liquid crystal display according to claim 47, by the comparatively easy configuration, dry washing of the substrate can be carried out at high speed, and cost is reduced, and sheet processing is attained.

[0081] According to the manufacture approach of a liquid crystal display according to claim 48, without making a liquid crystal panel side damage physically the dirt of the organic substance and the inorganic substance adhering to a liquid crystal cell, comparatively, at high speed, while being able to remove by low cost easily and being able to prevent a defect with tension for a polarizing plate effectively, sheet processing and processing in a site are attained.

[0082] According to the manufacture approach of a semiconductor device according to claim 49, after removing a defect's electronic parts, only a part required in order to re-join an excellent article is chosen, and surface treatment can be carried out comparatively easily also on the spot if needed, without affecting other parts.

[0083]

[Example] The structure of the suitable example of the surface treatment equipment by this invention is roughly shown in drawing 1 . The so-called surface treatment equipment 1 of the gun type made to generate gas discharge has the dielectric tubing 2 which consists of a quartz of thin meat which makes the shape of a cylindrical shape in general. The dielectric tubing 2 is arranged so that one pair of RF electrodes 3a and 3b may counter the peripheral face near [the] a center mutually on both sides of the dielectric tubing 2, and it constitutes the so-called capacity-coupling type of discharge structure. The outside is completely covered with an insulator 4, and further, the outside is equipped with Electrodes 3a and 3b so that the metal casing 5 of thin meat may wrap in the dielectric tubing 1 whole. A gas inlet 6 is established in the upper limit of the dielectric tubing 2, and it connects with a gas transfer unit 7 through a flexible tube 8, and the gas port 9 is established downward in the lower limit. The metal mesh 10 combined with metal casing 5 and one is arranged immediately at the gas port 9 bottom. Under a gas port 9 and the metal mesh 10, processed material 11 like a substrate turns upward it the side which carries out surface treatment, and is arranged.

[0084] It connects with the impedance-matching circuit 14 through a coaxial cable 13, and one electrode 3a is connected to RF generator 15 through this circuit. The end is grounded through the connector of the impedance-matching circuit 14, and, as

for the mesh metal wire of the periphery section of a coaxial cable 13, the other end is connected to electrode 3b of another side, or metal casing 5. It has flowed through electrode 3b according to metal casing 5 and the **** 16 screwed on from the outside, and metal casing 5, electrode 3b, and the metal mesh 10 are grounded by this. This is for reducing the effect of the RF electric field which prevention of electrification by the potential generated on the front face of an insulator 4 and the leakage of a RF give to the body. In addition, it connects with RF electrode 3a, and high-frequency voltage is impressed for while the core wire of a coaxial cable 13 has not flowed with a case 5 from a power source 15. Thus, since it can constitute movable in one as a gun type in addition to security when the power line period to be used is low when using especially the surface treatment equipment 1 of this invention on the spot by grounding metal casing 5 and the metal mesh 10 with a coaxial cable 13, workability improves. If there is no inconvenience on an activity, it is possible, grounding the metal mesh 10 naturally by the option.

[0085] Predetermined gas is supplied for gas supply to a gas inlet 6 through a flexible tube 8 from equipment 7, and said predetermined gas permutes the dielectric tubing 2 interior. If high-frequency voltage is impressed to one electrode 3a from a power source 15, gas discharge will occur in the dielectric tubing 2 interior between two-electrodes 3a and 3b. In the gas of the field 17 of this discharge condition, various reactions, such as dissociation of said gas by the plasma, ionization, and excitation, exist, and active species, such as an excitation kind of said gas and ion, are generated by these reactions. By supplying gas to the gas inlet 6 continuously from the gas transfer unit 7, the gas containing this active species blows off from a gas port 9 towards the front face of the processed material 11 as a reactant gas stream.

[0086] Although fixed to relative-displacement impossible about the dielectric tubing 2 in drawing 1 , according to another example of this invention, the periphery of the dielectric tubing 2 can be equipped with RF electrode pair 3a and 3b possible [a slide in the direction of an axis]. Therefore, by the location and it which gas discharge generates in the dielectric tubing 2 interior, a discharge field can be easily changed so that it may meet in said direction of an axis and a gas port 9 may be approached or deserted. By this, the class of gas introduced from a gas transfer unit 7, or by being directly exposed to the radiant heat and active species of discharge or an electrode, it can take into consideration on service conditions, such as effect the processed material 11 is influenced, and surface treatment can be adjusted.

[0087] Though natural, if luminescence of discharge [/ near RF electrodes 3a and

3b] is strong and the high-frequency power to impress increases, the discharge field 17 will spread in the dielectric tubing 1 interior. Moreover, when Electrodes 3a and 3b are located near the gas port 9, discharge jumps out of a gas port 9, and it becomes a phenomenon like a plasma torch. By controlling the flow rate of the high-frequency power impressed similarly and the oxygen contained in said introductory gas, or helium, said phenomenon can be promoted or this can also be controlled. For example, in a certain flow rate, as for helium, said phenomenon serves as a peak, and if, as for oxygen, the flow rate becomes excessive, the discharge itself will become like the arc discharge instead of glow discharge.

[0088] Moreover, since RF electrodes 3a and 3b are arranged on the outside of the dielectric tubing 2 and are not exposed to the plasma as mentioned above, they can prevent the effect of the contamination [exhausting / and / an electrode] to the processed material by the spatter etc. Furthermore, on the occasion of the continuous duty over a long period of time, the thermal effect which the radiant heat of Electrodes 3a and 3b has on processed material can be reduced.

[0089] As mentioned above, the trap of the ion in the plasma included in said gas stream by having formed the metal mesh 10 in the gas port 9 and the electron can be carried out, they can carry out a NYUTO rise, and ion can prevent beforehand the evil done to the processed material 11. However, by processed material, when there is no electric damage by ion substantially, or when there is no danger of electrification by the working condition, the structure of equipment, etc., it is not necessary to necessarily form the metal mesh 10.

[0090] If electrode pair 3a and 3b are made to approach a gas port 9 when the metal mesh 10 is formed in the location near a gas port 9, the gas discharge of a capacity integrated mold will arise also between electrode 3a by the side of a power source, and the metal mesh 10. Moreover, at least, it is the effect of the flow rate of impression power and introductory gas, flow rate, etc. partially, and gas discharge may be generated by turns between power-source electrode 3a, earth electrode 3b, and the metal mesh 10. Even if such a phenomenon covers the front face of the metal mesh 10 with an insulating material, it is the same. However, the arc discharge of electrode 3a by the side of a power source and the metal mesh 10 is prevented in that case. However, if a wrap insulating material is thick, the ion trap effectiveness which is the original purpose will reduce the metal mesh 10.

[0091] When the metal mesh 10 was not formed, and discharge jumped out of a gas port 9, it experimented in the effect which it has on processed material. The potential difference of processed material and touch-down potential was measured with the

oscilloscope, having exposed the metal of floating to said discharge electrically, and what potential having been shown, or changing the power line period of RF generator 7. This result is shown below. Here, Vdc is the potential at the time of impressing a direct current, and ****-p. It is the potential in an alternating current.

[0092]

(Power line period) (measurement potential)

13.56MHz -- Vdc= 1V ****-p = 3V 400kHz -- Vdc=-20V ****-p =10V 20kHz -- Vdc=-20V About ****-p =30V and 400kHz or less, the potential of the shape of a big pulse beyond 50V was measured occasionally. Or human being contacts the discharge field 17 directly from these results, when processing by having the metal of floating in a hand electrically, it is desirable to use preclusively a certain electrification prevention means usually used. It is also the same as when processed material is what is easy to be influenced of an electric damage.

[0093] On the other hand, when it provides the metal mesh 10, regardless of a power line period, both the above-mentioned electrical potential difference Vdc and ****-p are set to 0V, and processing with safe body and processed material is possible. However, since it jumps out of the metal mesh 10, and the discharge field 17 spreads further or a possibility of producing an arc also has it when especially a power line period is 400kHz or less, and the impression power is enlarged, cautions are required.

[0094] Moreover, according to this invention, the processed material 11 which is processed material can be cooled or heated. Such heating and cooling of the processed material 11 should just control the temperature of the processed material 11 indirectly by heating a holder 2 with a sheath heater, or cooling in a water pipe. The processed material 11 discharges and may be heated by 200 degrees C or more with the radiant heat of the gas stream blowing off or an electrode 3 depending on conditions. So, when it is required to protect the processed material 11 to heat, it processes, cooling the processed material 11. On the other hand, when the processed material 11 does not need the protection to heat, it should heat positively conversely. Since this invention is a kind of the reduction art using a chemical reaction, a reaction is promoted by heating in many cases. Moreover, if electrodischarge treatment by this invention is performed heating more than the melting point of solder where solder and components are carried on the processed material 11, it can solder to surface treatment and coincidence.

[0095] The light source of a halogen lamp etc. can be used as the another heating approach. According to this approach, it is possible to heat early the field which should be washed and it does not come out of loss of time amount as much as

possible few, and even if processed material is the complicated configuration where irregularity is intense, it can heat comparatively easily. Moreover, you may irradiate using said light source, the light, i.e., the ultraviolet rays, of short wavelength. In this case, chemical association of not only the heating effectiveness but the organic substance is cut, and the effectiveness of raising washing capacity further is also acquired.

[0096] Moreover, when performing electrodischarge treatment [long duration], it is desirable to cool RF electrodes 3a and 3b. This aims at cooling the dielectric tubing 2 exposed directly to discharge, and can consider well-known various approaches. For example, as the cooling approach of RF electrodes 3a and 3b, when a water-cooled pipe etc. is used, it is desirable to set the die length to 30cm or more in consideration of the conductivity of water by a water-cooled pipe using an insulating thing.

[0097] Moreover, in the example mentioned above, when removing the organic substance, such as flux, from processed material 11 front faces, ultraviolet rays are irradiated on processed material 11 front faces with the ultraviolet-rays generating means arranged near the processed material 11, and warm air or cold blast may be fed with a blow means, and the organic substance may be disassembled auxiliary or you may cool [the processed material 11 may be direct-heated and]. Moreover, the particle covered with the organic substance, such as a resist, is removable to coincidence by establishing further a means to vibrate said blow means or the processed material 11.

[0098] By being exposed to the active species generated by gas discharge in introductory gas using the surface treatment equipment 1 mentioned above, reforming of the front face of the processed material 11 is carried out, and its wettability improves sharply. It is convenient if the high-frequency voltage of 13.56MHz and several 10kHz, for example, 20kHz, is used according to the class of said introductory gas as an electrical potential difference impressed to Electrodes 3a and 3b. Unless it has a bad influence on processed material, such as rare gas, such as helium, nitrogen, the compressed air, and oxygen, all **** gas can be used for the gas introduced in the dielectric tubing 2 from a gas transfer unit 7. However, it is desirable to, use gas other than oxygen for example, when oxidation is not desirable for the processed material 11.

[0099] Moreover, the mixed gas of helium and oxygen can be introduced from a gas transfer unit 7 to remove the organic substance adhering to processed material 11 front faces, for example, the flux which remains after soldering. Thereby, active species, such as ion of oxygen and an excitation kind, are generated, and this reacts

with said organic substance, serves as a carbon monoxide, a carbon dioxide, and a steam of water, and separates from a processed material front face. This reactant gas can be exhausted with the duct arranged near the processed material 11.

[0100] For example, where it used the mixed gas of helium and oxygen for said introductory gas, and it set the flow rate of helium and oxygen to 20SLM(s) and 200SCCM(s) in a certain example, respectively and flow rate of oxygen is made into about 1%, high-frequency voltage with a frequency of 13.56MHz was impressed with the power of 80W. In the dielectric tubing 2 interior, the white discharge (plasma) which was bluish for a while occurred. In this case, the generated active species is the radical of oxygen. The processed material 11 used the ceramic substrate (7059 by Corning, Inc. glass), on it, applied 1 micron (Tokyo adaptation shrine OFPR- 800) of novolak system resists, and baked them. It reacted with said resist which is the organic substance, and the oxygen radical contained in said gas stream, it became a steam, a carbon dioxide, etc., and was removed from said processed material front face.

[0101] Moreover, even if it replaces with the mixed gas of helium and oxygen as gas for discharge and uses the mixed gas of the compressed air, nitrogen, and oxygen, the effectiveness, i.e., the ashing effectiveness, of removing the organic substance similarly is acquired. Furthermore, also when introductory gas is used as a rare-gas simple substance, it is possible to acquire the ashing effectiveness similarly.

[0102] For example, only gaseous helium is supplied in the dielectric tubing 2 through a flexible tube 8, discharge of only gaseous helium is generated, and the gas stream containing the active species is made to blow off from a gas port 9. By the energy exchange of the oxygen in the atmospheric air which exists in a gas port 9 and the metal mesh 10 neighborhood, and a list automatically between it and the processed material 11, and the helium radical generated by discharge, an oxygen radical is generated and ashing is performed. Therefore, ashing with more effective removing the metal mesh 10 of the direction [it controlled in this case to turn the discharge field 17 to the processed material 11 from a gas port 9, and to jump out of it] becomes possible. According to this approach, since discharge in the dielectric tubing 2 interior is performed only by rare gas, contamination of the dielectric tubing 1 interior etc. is prevented or controlled, and the discharge stability over a long period of time is not only acquired, but since it is unnecessary to supply oxygen as reactant gas, there is an advantage on cost.

[0103] An oxide, for example, the CuO oxide film formed in the copper pad front face, is removable from the front face of the processed material 11 by using the gas which

contains nitrogen, a fluorine compound (CF4, C2F6, SF6 grade), or the organic substance as gas for discharge. In this case, said oxide reacts with active species, such as ion of nitrogen, and an excitation kind, turns into nitrogen oxides, or reacts with active species, such as ion of a fluorine, and an excitation kind, turns into a fluoride, and separates from the front face of the processed material 11. In the case of the gas containing the organic substance, said organic substance reacts with active species, such as ion of the organic substance dissociated, ionized, excited and generated, carbon, and hydrogen, and an excitation kind, and the oxide of said processed material front face becomes a hydroxy compound, an oxo compound carboxylic acid, a carbon dioxide, a steam, etc., and separates from said processed material front face.

[0104] The same effectiveness is acquired even if it applies said organic substance to the front face of the processed material 11. In this case, it sets to the discharge field 17, gas dissociates, ionizes and excites by the plasma, and an energy state becomes high. A part evaporates, and said organic substance applied to the processed material front face is exposed to discharge, is dissociated, ionized and excited, and serves as active species, such as ion of the organic substance, carbon, and hydrogen, and an excitation kind. Moreover, other parts receive and excite [dissociate, ionize and] energy from the active species of the high gas of an energy state, and serve as active species, such as ion of the organic substance, carbon, and hydrogen, and an excitation kind. The same operation effectiveness as the case where the gas which added the organic substance is used by these active species is acquired. And this active species does not remain on a processed material front face like the chlorine compound contained in flux.

[0105] As gas by which the etching effectiveness of removing oxide from processed material 11 front faces similarly is acquired, there is mixed gas of helium or the compressed air, and carbon tetrafluoride (CF4), for example. Moreover, oxygen may be used instead of the compressed air. In carbon tetrafluoride, the effectiveness which controls the breadth of discharge is accepted, when putting in too much, localization becomes intense in the dielectric tubing 2 interior, and the discharge field 17 stops being able to jump out of a gas port 9 easily. However, once the discharge field 17 will jump out of a gas port 9 conversely, the skirt will be pulled on processed material 11 front faces, and breadth and its etching field will be extended.

[0106] In this example, when the flow rate of said mixed gas was set to helium 20SLM and CF4100SCCM, the etch rate was a part for about 10-micron/. Moreover, the etching rate became large when 100SCCM(s) added oxygen as mixed gas. For

example, when it was the mixed-gas system in which a fluorine compound (for example, CF4) is suitably contained 1% of suitably 0.5 - 5% of oxygen 1% 0.5 to 5% to helium, it was checked by the invention-in-this-application person that the etching effectiveness serves as max.

[0107] If rare gas, such as helium, is used under atmospheric pressure or the pressure of the near and the electrical potential difference of high frequency is generally impressed, it will be easy to generate gas discharge, and the discharge can lessen the damage given to the uniform and exposing member, but since gas itself is expensive, cost increases. Then, only at the time of discharge starting, the rare gas which is easy to start discharge from a gas transfer unit 7, such as helium and an argon, is introduced, and it can also change into other suitable cheap gas, after impressing an electrical potential difference and generating discharge. Moreover, in an option, mixed gas with reactant gas, such as rare gas, such as helium, oxygen, and CF4 or CF4, oxygen, is supplied to a gas inlet 6 through a flexible tube 8 from a gas transfer unit 7, and when discharge is generated, only rare gas suspends supply. And it considers as discharge of only reactant gas. In this case, although discharge is maintained, that gestalt tends to serve as arc discharge.

[0108] For example, in the mixed gas of helium and oxygen, the one where oxygen flow rate is smaller can start discharge with low impression power. However, if the flow rate of helium becomes small even if an oxygen flow rate is small, it will be hard coming to generate discharge. Furthermore, in respect of continuation of discharge, the discharge in which the one where oxygen flow rate is smaller resembled beautiful glow discharge is maintainable. If an oxygen flow rate is increased, the discharge field 17 will localize, and it shifts to a HOSSU corona soon, or changes to a gestalt like the arc discharge accompanied by a loud sound. If it becomes discharge like this arc discharge, as for the part of the dielectric tubing 2 close to the discharge field 17, temperature will rise. Once discharge begins, discharge will also maintain oxygen flow rate with difficult discharge starting. However, in the dielectric tubing 2, if possible, it was thin and many HOSSU coronas were observed, without shifting to arc discharge in this example by being thin in 15mm or less and the thickness of those, and being referred to as 1mm or less in this example.

[0109] Moreover, it is also possible only for reactant gas to use the mixed gas of nitrogen and reactant gas from the beginning without completely using rare gas, as mentioned above. A stable HOSSU corona can be obtained by making small especially the power line period of RF generator 15. For example, if the high-frequency voltage of 20kHz is used, initiation of discharge is also possible at a

compressed air. Since processing speed will not fall so much even if said dielectric tubing 2 interior shifts to arc discharge, this approach can carry out considerable reduction of the running cost by paying attention to cooling of the discharge field 17, the heat-resistant temperature of the processed material 11, etc. This approach is strong on a damage thermal [processed material] and electric, and when low cost processing is desired, it is suitable, and it mainly contributes to the chlorofluocarbon loess for global environmental protection, and a TORIE tongue loess activity.

[0110] The modification of the example of drawing 1 which has the supply means of reactant gas separately [a gas transfer unit 7] is shown in drawing 2 . the gas which carries out opening of said reactant gas supply means between a gas port 9 and the metal mesh 10 -- it has a conduit 18. From a gas transfer unit 7, rare gas, for example, helium, is supplied to the dielectric tubing 2, and discharge of only gaseous helium is generated. on the other hand, the purpose of the processing from said reactant gas supply means -- responding -- reactant gas, such as mixed gas of the CF4 or CF4, and oxygen for the compressed air for the oxygen for ashing, and the improvement in wettability, or etching, -- gas -- the field between a gas port 9 and the metal mesh 10 is supplied from a conduit 18. It is generated by gas discharge, and a labile kind is generated by the energy exchange of the helium radical which serves as a gas stream and is spouted from a gas port, and said reactant gas, and this performs surface treatment of the processed material 11. Though natural, surface treatment with more efficient removing the metal mesh 10 is possible.

[0111] Thus, according to this invention, the organic substance, such as flux which dry washing of the front face of processed material is carried out, it is reformed, and wettability is raised sharply, and carries out etching removal of the oxide, or remains after soldering, is also certainly [easily and] removable. Furthermore, according to this invention, such effectiveness can be further heightened by applying moisture to the reactant gas containing said active species. It was checked by the invention-in-this-application person that the processing speed becomes remarkable early especially as for the etching effectiveness. For example, in order to remove the CuO film of the copper pad front face of a substrate, when helium and 4 oxygen-fluoride mixed gas were used and the moisture of a steam etc. was applied to this, removal which had taken about 20 minutes when moisture was not applied was able to be realized in small about 20 seconds.

[0112] The concrete configuration for adding moisture to drawing 13 thru/or drawing 15 so that the effectiveness of the electrodischarge treatment by this invention may be heightened, respectively is shown. In the example shown in drawing 13 , from a gas

transfer unit 7, a bypass is formed in the middle of the pipe 72 which supplies gas to surface-preparation equipment 71, and it branches, and said a part of gas is adjusted by the bulb 73, and it is sent in in a tank 74. the inside of a tank 74 -- water -- pure water 75 is stored suitably, and it is heated at a heater 76 and is carrying out that it is easy to generate a steam. It is again returned to a pipe 72 including a steam, it mixes with said gas directly fed from a gas transfer unit 7, and the gas introduced in the tank 74 is supplied to surface treatment equipment 71.

[0113] Thus, by including moisture in the gas sent to surface treatment equipment 71, there is no possibility of producing dew condensation in processed material, and it is convenient. Moreover, the amount of the moisture to add is adjusted by adjusting the temperature of the water 75 in a tank 74 from the opening and the heater 76 of a bulb 73.

[0114] In the another example shown in drawing 14 , an atomizer 77 is formed in the middle of the pipe 72 which leads to said surface treatment equipment from a gas transfer unit 7, and water 75 is supplied to this from a tank 74. Thereby, moisture can be added to the gas sent to said processor. In this case, the atomization of water can also be promoted by forming the same heater as the example of Fig. 21 in a tank 74, and supplying warm water to an atomizer 77. Moreover, a ventilation means and a duct can be prepared separately [a gas transfer unit 7 and a pipe 72], and the moisture atomized with the atomizer 77 can also be compulsorily fed in the dielectric tubing 2 in direct, for example, the 1st example, at said surface treatment equipment.

[0115] In the example of drawing 15 , the water 75 in a tank 74 is heated at a heater 76, a steam is generated, and it can supply near the front face of processed material electrodischarge treatment is performed with a pipe 78 directly. in this case -- the case where there is a possibility of having the effect which is not desirable on said processed material by dew condensation although dew condensation may be produced on the front face of processed material with comparatively low temperature -- a pipe 78 -- said surface treatment equipment -- or the pipe 72 -- on the way -- before it is alike, connecting and producing discharge, it can also add in said gas.

[0116] Furthermore, according to this invention, electrodischarge treatment can be performed to the processed material of various quality of the materials, such as a metal and a resin ingredient, for example, even if it is oxides, such as glass and ITO, it is checked that a good result is obtained. When a nitrogen simple substance is used as gas for discharge to a glass ingredient, it should observe in that the outstanding wettability is acquired and this forms the precoat of solder in the glass side of a liquid

crystal panel beforehand, and it also becomes possible to mount IC chip etc. directly, without connecting through a TAB substrate. also when carrying out silk screen printing of a manufacturer name and the part number to the resin package external surface of the electronic parts by which the resin seal was carried out, before [moreover,] printing the surface treatment of this invention -- or adhesion of ink can be improved by giving at the time of the desiccation after printing.

[0117] The 2nd example of the surface treatment equipment by this invention is shown in drawing 3 . The perimeter is continued and equipped with RF electrode 3 which impresses high-frequency power, and the outside is covered with an insulator 4 by the periphery of the dielectric tubing 2, and it is prepared in it so that the metal covering 19 may hold the dielectric tubing 2 whole in the outside further. the example of drawing 1 -- the same -- the dielectric tubing 2 -- the upper limit -- a gas inlet 6 -- and it has a gas port 9 in a lower limit. The metal mesh 10 is combined with the location below a gas port 9 in one by the lower limit of the metal covering 19. RF electrode 3 is connected to the RF generator which similarly is not illustrated through the impedance-matching circuit which is not illustrated. The metal covering 19 and the metal mesh 10 are grounded. Connection between an electrode 3 and said power source and touch-down of the metal covering 19 can be performed through a coaxial cable like the 1st example. If the gas introduced from a gas inlet 6 permutes the dielectric tubing 2 interior and high-frequency voltage is impressed to an electrode 3 from said power source, gas discharge will happen between this electrode and the grounded metal mesh 10. And carrying out the trap of the ion by the metal mesh 10, the gas stream containing the active species of said introductory gas is applied to the processed material 11, and surface treatment is performed.

[0118] It is checked in the experiment of an invention-in-this-application person that processing speed may be improved without giving an electric damage to processed material, securing safety by taking such a discharge format.

[0119] Moreover, in the 2nd example, it can also consider as the configuration which does not form the metal mesh 10. In this case, it can be regarded as the electrode which grounded the processed material 11, and discharge can be generated between RF electrodes 3. This discharge format is effective, when processed material can disregard an electric damage, or when surface treatment equipment is held in a certain case and safety is secured.

[0120] The 3rd example of the surface treatment equipment by this invention is shown in drawing 4 . This surface treatment equipment 20 is equipped with the glass tube 21 which replaces with the dielectric tubing 2 of the 1st example, and consists

of dual structure of the same axle. The gas port 9 is established at the lower tip at which the upper limit is opened wide, and the lower limit is blockaded, and the inside glass tube 22 makes the shape of a cone in general while the upper limit is closed and, as for the outside glass tube 23, it demarcates the annular vacant room 24 between the inside glass tubes 22. Moreover, a gas inlet is established in the upper limit of the annular vacant room 24, and it connects with the external gas transfer unit.

[0121] Into the inside glass tube 22, round bar-like RF electrode 25 is inserted possible [extraction and insertion] from the upper limit opening. The electrode 25 is connected to the RF generator by the coaxial cable through the impedance-matching circuit like the 1st and 2nd example of the above. The conic electrode 26 grounded as a counter-electrode of RF electrode 25 covers the perimeter, and is attached in the peripheral face of the cone-like lower part of the outside glass tube 23. If gas is introduced in the annular vacant room 24 from said gas inlet and high-frequency voltage is impressed to an electrode 25, gas discharge will occur between the power-source lateral electrode 25 in this annular vacant room, and an earth electrode 26. By pulling out an electrode 25 within the inside glass tube 22, or inserting and changing the tip location, the location of the discharge field 27 can be moved like the 1st example, and it can adjust.

[0122] Although any example mentioned above has adopted the discharge format of a capacity-coupling mold, even if it is the discharge gestalt of an inductive-coupling mold, the operation effectiveness with the same said of the electrodeless discharge by the microwave of short wavelength is acquired. However, when using microwave, connection by the coaxial cable of said impedance-matching circuit and said RF electrode becomes difficult, and there is a possibility that the convenience on an activity may be spoiled as a gun type used on the spot. Moreover, in each example mentioned above, it is possible making a gas port thin or by arranging a mask means between a gas port (or metal mesh) and the processed material 11 to limit and process the part of a processed material front face.

[0123] Three examples of the surface treatment equipment which adopted the discharge format of an inductive-coupling mold are roughly shown in drawing 5 . The example shown in drawing 5 A is equipped with the long and slender discharge tube 28 which consists of cylinder-like dielectric materials in general. The gas inlet 29 which the discharge tube 28 arranged horizontally opens for free passage to a gas transfer unit at the end is formed, and the other end is blockaded. In general, the coiled form electrode 30 connected to the RF generator covers an overall length, and is wound around the periphery of the discharge tube 28. The insulator was covered

by the outside of the coil electrode 30, and metal covering has covered the discharge tube 28 whole for the outside. Moreover, two or more gas ports 31 are formed [at the discharge tube 28] on the straight line along the direction of an axis the periphery. In such a configuration, the coil electrode's 30 impression of high-frequency voltage generates gas discharge to which the discharge field 32 spreads inside [whole] discharge tube 28. And the gas stream containing the active species by discharge is injected towards the front face of processed material from each gas port 31.

[0124] In the deformation example of drawing 5 B, the discharge tube 28 of dielectric materials is arranged perpendicularly, and the coil electrode 30 is wound around the periphery. The gas inlet which is not illustrated prepares in the upper limit of the discharge tube 28, and the gas port 31 is formed in each point which branched in ** and a lower limit at plurality. With this configuration, since the discharge field 32 is formed in the location isolated from the gas port 31, even if it does not prepare a metal mesh in a gas port 31, it is not necessary to carry out consideration on the insurance to the electric damage and the body which are given to processed material.

[0125] In the another example shown in drawing 5 C, the lower limit of the discharge tube 28 which similarly wound the coil electrode 30 forms the gas port 31 expanded in the shape of a horn. Surface treatment of the large area of processed material can be carried out at once in the thereby comparatively small discharge field 32. Moreover, since a gas port 31 can be completely put on processed material when performing surface treatment under the environment where he does not want to affect the perimeter of processed material, it is convenient.

[0126] Drawing 6 shows roughly the processor 33 suitable for carrying out electrodischarge treatment of the processed material locally on the spot if needed. The discharge generating section 35 is formed in the interior of the nozzle 34 of the shape of a cylinder which has the so-called structure of the gun type as for which an operator can work, having a processor 33 in a hand if needed, and has opening at the tip. From the lower part of the discharge generating section 35, the reactant gas stream containing the active species generated by discharge is guided at the tip opening 36 of a nozzle 34, and spouts the discharge generating section 35 towards the front face of the processed material 11 while having the same basic structure as each example mentioned above and connecting with the gas transfer unit and power source which are not illustrated.

[0127] The discharge generating section 37 and the nozzle section 38 which injects a reactant gas stream are separately formed in drawing 7 A, and the surface treatment

equipment 40 which connected these with the flexible tube 39 is shown. It is built in the body 41 of fixed [which built into one the power source which is not illustrated, the gas transfer unit, etc.], or a portable type, the reactant gas stream generated there is fed through a flexible tube 39, and the discharge generating section 37 is made to blow off from the nozzle section 27 to the processed material 11. 5m ****** can make active species reach [die length / of a flexible tube] processed material effectively to about 2m. Thus, while workability improves by using the nozzle section 38 as another object, the throughput of equipment 40 can be heightened if needed.

[0128] It is equipped with the nozzle section 38 at the tip of a flexible tube 39 possible [removal]. Such the exchangeable nozzle section 42 is shown in drawing 7 B. The nozzle section 42 of drawing 7 B is suitable for processing nothing and a comparatively small part in the rectangle to the ability of the nozzle section 38 of drawing 7 A to process nothing and a large area for comparatively big discoid at once. Thus, by exchanging the nozzle section suitably, it can respond to change of a processed material or a service condition easily, and the flexibility on an activity improves.

[0129] According to this invention, as mentioned above, surface treatment equipment and processed material can be made movable relatively easily, and many parts are processed by it or it becomes possible to enlarge area which can be processed at once. Moreover, when the frequency of the RF generator to be used is 13.56MHz or less, by connecting an impedance-matching circuit and an RF electrode with a coaxial cable 13, especially migration becomes easy and the automation field system using a robot etc. of it becomes possible.

[0130] The example of the so-called Rhine type which can process the front face of processed material in the shape of a straight line at once of surface treatment equipment is shown in drawing 8 . This surface treatment equipment 43 is equipped with the thin dielectric plate 44 which consists of one pair of quartzes which counter right and left with narrow fixed spacing. The narrow-width vacant room demarcated among them along with the longitudinal direction of both the dielectrics plate 44 forms the gas port 46 where lower opening is prolonged in a narrow-width longitudinal direction when the lower part of both the dielectrics plate 44 inclines in the inside sense, respectively while forming the gas inlet 45 where the order both ends are blockaded, and up opening is connected to a gas transfer unit. Moreover, according to another example, a gas port 46 can also be formed with the small nozzle of a large number located in a line in the shape of a straight line.

[0131] It is arranged in the location where one pair of RF electrode plates 47

continued and extended for an overall length along with a longitudinal direction, respectively counter the lateral surface of both the dielectrics plate 44. The outside of the RF electrode plate 47 is covered with an insulator 48, and the metal covering 49 is attached in the outside for the purpose of protection of the electrode plate 47 and electric shielding of an electromagnetic wave. An electrode plate pair 47 can slide the external surface top of the dielectric plate 44 in all the **** directions in the condition of having countered mutually, like the case of the 1st example. Therefore, the location which produces gas discharge between said vacant rooms between the dielectric plates 44, and its discharge field can be changed easily. Moreover, the metal covering 49 can also make it structure which includes the surface treatment equipment 43 whole.

[0132] One electrode plate 47 is connected to the impedance-matching circuit and the RF generator through the coaxial cable like the example mentioned above. The electrode plate 47 of another side flows with the metal covering 49, and is grounded through the mesh metal of said coaxial cable periphery. Moreover, the cooling means is established in preparation for consecutive processing covering long duration in the two-electrodes plate 47. Furthermore, the metal mesh which is not illustrated can be arranged between processed material, and the gas port 46 bottom can be made to be able to combine this with the metal covering 49, and it can ground to it.

[0133] If gas is introduced from a gas inlet 45, the inside of said vacant room is permuted and high-frequency voltage is impressed to an electrode 47, the longitudinal direction of the dielectric plate 44 will be covered at an overall length, and gas discharge will occur in its near between the two electrodes 47 in said vacant room. The reaction kind of said gas activated by this discharge is irradiated by the front face of the processed material 11 arranged down the gas port 46. In this example, a large area can be processed by processing the processed material 11 in the shape of a straight line, and moving the processed material 11 and a processor 43 relatively by the above-mentioned configuration. Moreover, though natural also in this case, it can replace with high frequency discharge and the electrodeless discharge by microwave can be used.

[0134] When the location of the electrode plate 47 is moved below along the external surface of the dielectric plate 44 and a gas port 46 is made to approach, said discharge will jump out of a gas port, and it will be directly exposed to the active species by which the processed material 11 was activated. If the electrode plate 47 is moved upwards and a discharge field is isolated from a gas port 46, said reaction kind will be exposed to the processed material 11 as a gas stream which flows out of

a gas port.

[0135] When it is going to remove the organic substance, such as flux which remains on the front face of the processed material 11, using the surface treatment equipment 43 of this example, the mixed gas of helium and oxygen is introduced in said vacant room. In this example, the surface treatment equipment which carried out opposite arrangement of one pair of dielectric plates 44 with a thickness of 1mm at intervals of 2mm was used, the flow rate of helium and oxygen was set to 20SLM(s) and 200SCCM(s), respectively, flow rate of oxygen was made into about 1%, and the high-frequency voltage of 13.56MHz was impressed with the power of 80W, and surface treatment of the ceramic substrate which applied the resist was carried out. The oxygen radical was generated as a reaction kind by discharge, and it reacted with the resist on said substrate, and it became a steam, a carbon dioxide, etc. and was removed.

[0136] Another example of Rhine type surface treatment equipment is shown in drawing 9 , and it has cross-section structure similar to the example of drawing 4 . It has the inside glass plate 50 and the perpendicular outside glass plate 51 of two sheets which counters in parallel and mutually with predetermined spacing on the perpendicular inside glass plate 50 which countered mutually with narrow fixed spacing, and was combined in the lower limit so that it might have the cross section of U typeface in general and outside of two sheets. The vacant room of the cross-section U typeface demarcated between the inside glass plate 50 and the outside glass plate 51 Along with the longitudinal direction, it continues and extends for an overall length, and the gas inlet 52 of a large number connected to a gas transfer unit is arranged in the upper limit. In a lower limit The lower part of each outside glass plate 51 inclines in the inner sense, the narrow-width fixed gas port 53 covers a longitudinal direction like the example of drawing 8 at an overall length, and it is formed in the shape of a straight line.

[0137] Thin plate-like RF electrode 54 continued and extended for an overall length at the longitudinal direction makes the upper limit of the inside glass plate 50 stop the upper limit section which makes the T typeface in the interior of the inside glass plate 50, and is inserted in it possible [extraction and insertion]. In the external surface of said lower part which inclines in the sense among each outside glass plate 51, the sheet metal-like electrode 55 continued and extended for an overall length at a longitudinal direction, respectively is arranged near the gas port 53. an electrode 54 is connected to an RF generator -- having -- and the electrode 55 -- as the counter-electrode -- touch-down -- now, it is. Moreover, the upper limit of the

electrode 54 which projects from the inside glass plate 50 is covered with an insulator 56, and the metal covering 57 is attached in the outside so that the whole surface-preparation equipment may be covered.

[0138] Thus, if high-frequency voltage is impressed between an electrode 54 and 55 by constituting, gas discharge will arise within said vacant room near the gas port 53 between them. Therefore, in this example, there is an advantage that surface treatment with good power efficiency is performed, by forming the discharge field 58 near the processed material.

[0139] Still more nearly another Rhine type example is shown in drawing 10 . In this example, the gas port 60 of the shape of a straight line which the perpendicular outside glass plate 59 of two sheets counters mutually, and that lower part inclines in the inside sense like the outside glass plate 51 in the example of drawing 9 , respectively, and is extended to a longitudinal direction among them is formed. It is made by each outside glass plate 59 so that sheet metal-like one pair of RF electrodes 61 may cover an overall length, and may be prepared in a longitudinal direction to the location immediately on said lower part which inclined from the upper limit in accordance with the inside and the inside glass plate 62 may close an electrode 61 between the outside glass plates 59 to the inside. As a counter-electrode of the electrode 61 connected to the RF generator, one pair of grounded electrodes 63 make the external surface of said lower part of the outside glass plate 59 approach a gas port 60, and are stuck on it. Moreover, a gas inlet 64 is formed of opening demarcated by the upper limit of the inside glass plate 62 which counters. In this example, gas discharge occurs within said vacant room near the gas port 60 between each adjoining RF electrode 61 and each adjoining earth electrode 63 like the example of Fig. 9.

[0140] Drawing 11 and drawing 12 show the modification of the discharge generating structure used for the surface treatment equipment by this invention. It is stuck on the location where one pair of dielectric plates 64 in which two or more **** which correspond, respectively were formed on the field which counters are joined mutually, and one pair of electrodes 65 and 66 counter the both-sides side in drawing 11 . One side of electrodes 65 and 66 is connected to an RF generator, and another side is grounded, gas is introduced in the gas passageway 67 formed of said ****, and discharge is generated. Moreover, such a gas passageway can be formed also by punching one member which consists of dielectrics.

[0141] A gas port 68 is formed in L typeface, and, as for drawing 12 , one pair of electrodes 69 and 70 are arranged in the both sides. The configuration of a gas port

68 can be made into various configurations other than L in all typefaces at the configuration of a part of performing surface treatment of processed material, and it can be processed, without affecting only the part which processed material limited by it in any way at other parts.

[0142] Next, using the surface-preparation approach of this invention mentioned above, electronic parts and a lead are connected, and it closes by resin, and how to manufacture the semiconductor device of a package mold is explained. it is shown in drawing 16 -- as -- the gas port 9 of the surface treatment equipment 1 of drawing 1 , and the metal mesh 10 -- below, electronic parts 79 and lead 80 are immediately arranged as processed material. This electronic parts 79 and lead 80 are for manufacturing the semiconductor device of a DIP (Dual Inline Package) mold as shown in drawing 17 , and each electrode pad of the electronic parts 79 of the bare chip pasted up on the die pad 81 and the corresponding lead 80 are connected with the wire 82 of gold or aluminum, respectively.

[0143] If gas is introduced from said gas transfer unit and an electrical potential difference is impressed to said electrode, discharge occurs within the dielectric tubing 2, the gas stream containing the active species of said gas blows off from a gas port 9, the metal mesh 10 will be passed, electronic parts 79 and lead 80 will be exposed, and desired surface treatment will be made. Next, as shown in drawing 17 , mold resin 83 encloses these, and a package 84 is formed. By this surface treatment, since wettability of the front face [electronic parts 79 and] of lead 80 improves sharply, a contact angle with mold resin 83 becomes small, and its adhesion of both improves. When a clearance exists in mold resin 83, electronic parts 79, or an interface with lead 80, said clearance is covered with the moisture which invaded in the package 84, electronic parts 79 are polluted or there is a possibility of expanding according to the elevated temperature at the time of a reflow, and making a package generating a crack. While these troubles are canceled and dependability improves remarkably by raising the adhesion of mold resin by this invention, the yield improves.

[0144] Moreover, what is necessary is just to make it exposed to said gas by which the mask means mentioned above when it was easy to corrode in the gas by which the case where a problem is in adhesion with electronic parts 79 although the adhesion with lead 80 has good mold resin 83, and lead 80 contain active species is arranged between the metal mesh 10, electronic parts 79, and lead 80, or magnitude of a gas port 9 is made small, and only electronic parts 79 contain active species. On the contrary, a mask means is used similarly, or the configuration of a gas port 9 is changed, and mold resin 83 should just be made to expose to said gas by which only

lead 80 contains active species, when the case where a problem is in adhesion with lead 80, and electronic parts 79 tend to be influenced of the electron by discharge, or ion, although the adhesion with electronic parts 79 is good.

[0145] In the another example, before connecting electronic parts 79 and lead 80 by wirebonding, surface treatment of the surface treatment equipment 1 can be used and carried out. In this case, in the condition just before wirebonding of the electronic parts 79 and the lead 80 which were pasted up on the die pad 81 is carried out, both can be put in order, and it can process to coincidence, or surface treatment of electronic parts 79 and the lead 80 can be carried out separately. Since electronic parts 79 and the front face of lead 80 are activity in these cases, respectively, while both junction nature improves, in case resin encloses, adhesion with this resin improves collectively. Moreover, though natural, surface treatment of either electronic parts 79 or the lead 80 can also be carried out. Furthermore, according to this invention, only electronic parts 79 or the required part of lead 80 can be alternatively processed in the precision of about 2-3mm.

[0146] Moreover, in the another example, resin can enclose the electronic parts connected to wiring of a tape career instead of a package like DIP mentioned above, and the semiconductor device of a TCP mold can be manufactured. For example, before carrying out a resin seal by TORANFA mold after carrying out wirebonding of the electrode of IC chip to the electrode pad of a tape career, or before carrying out a resin seal by the after [ILB] potting mold which connects IC chip to the inner lead of a tape career, surface treatment by the gas containing the active species mentioned above can be performed, and adhesion with mold resin can be raised. Moreover, the manufacture approach of the semi-conductor of this invention is applicable similarly about the semiconductor device of various resin seal form packages, such as not only DIP and TCP of the above-mentioned example but SIP, ZIP, MFT, SOP, etc.

[0147] Here, when experimented about the type of gas to be used using helium, an argon, oxygen, nitrogen, hydrogen, and these mixed gas, improvement in mold resin 83, electronic parts 79, or adhesion with lead 80 was checked about all these types of gas. Moreover, about the power source, when experimented on the frequency of 10kHz, 400kHz, and 13.56MHz, improvement in mold resin 80, electronic parts 79, or adhesion with lead 80 was similarly checked with these perimeter wave number. These experimental results are as being shown below.

[0148] First, the improvement of the wettability by the surface treatment of this invention was checked. In this experiment, surface treatment by this invention is

performed on the front face of processed material for 5 seconds. What measured the contact angle using the drop type contact angle meter, and did not perform surface treatment at all, And although there were some differences by the use type of gas as shown in Table 1 when the contact angle was similarly measured about what was processed for 15 minutes with the conventional technique using the oxygen gas activated under reduced pressure and having been compared with this invention, the result which shows the remarkable effectiveness of this invention was obtained.

[0149]

[Table 1]

接触角

処理方法	使用ガス	処理時間	電源周波数	接触角
未処理				９７度
従来処理	O_2	１５分	１３．５６ＭＨｚ	６０度
本発明	O_2	５秒	１０ＫＨｚ	５１度
本発明	H_2	５秒	１０ＫＨｚ	５３度
本発明	N_2	５秒	１０ＫＨｚ	５６度
本発明	N_2 ＋ O_2	５秒	１０ＫＨｚ	５２度
本発明	Ａｒ	５秒	１０ＫＨｚ	６２度
本発明	Ｈｅ	５秒	１３．５６ＭＨｚ	６０度
本発明	Ｈｅ＋ O_2	５秒	１３．５６ＭＨｚ	５１度
本発明	Ｈｅ＋ H_2	５秒	１３．５６ＭＨｚ	５２度
本発明	Ｈｅ＋ N_2	５秒	１３．５６ＭＨｚ	５５度

Next, it experimented about the crack initiation of the package resulting from mold resin, electronic parts, or adhesion with a lead. The electronic parts with which both performed surface treatment of this invention and the group of a lead, and the electronic parts which performed surface treatment of the conventional technique with which both mentioned above and the group of a lead, The electronic parts with which both did not perform surface treatment at all, and the group of a lead After making it dry at 125 degrees C for 10 hours and making it absorb moisture for 504

hours within the ambient atmosphere of the temperature of 85 degrees C, and 85% of humidity, when reflow processing was performed for 10 seconds at 250 degrees C and the incidence rate of a crack was checked about 3 sets of packages which carried out the resin seal after joining, respectively, the result shown in Table 2 was obtained. Thereby, although according to this invention the processing time was slight or was 1/180 as compared with the case where it is based on the conventional technique, the effectiveness of the improvement in adhesion was accepted more than comparable at least.

[0150]

[Table 2]

クラック発生率

処理方法	使用ガス	処理時間	電源周波数	クラック発生率
未処理				30／30
従来処理	O_2	15分	13.56MHz	5／30
本発明	O_2	5秒	10KHz	0／30
本発明	H_2	5秒	10KHz	0／30
本発明	N_2	5秒	10KHz	3／30
本発明	N_2 + O_2	5秒	10KHz	0／30
本発明	Ar	5秒	10KHz	7／30
本発明	He	5秒	13.56MHz	5／30
本発明	He+ O_2	5秒	13.56MHz	0／30
本発明	He+ H_2	5秒	13.56MHz	0／30
本発明	He+ N_2	5秒	13.56MHz	3／30

Furthermore, it experimented in the defective incidence rate about the component destruction which the ion generated by discharge and an electron produce by the damage given to electronic parts. In the experiment, about the electronic parts which performed surface treatment of this invention for 1 hour using the 10kHz power source, the electronic parts which similarly performed surface treatment of this invention for 1 hour using the 13.56MHz power source, and the electronic parts which

performed surface treatment of the conventional technique mentioned above for 1 hour, when each defect incidence rate was investigated, the result of Table 3 shown below was obtained. According to this experimental result, in the case of the surface treatment of this invention using a 13.56MHz power source, it turns out that a defect incidence rate is the lowest. From now on, the frequency of MHz order can say that there are few damages. However, since the time amount which the surface treatment of this invention actually takes is a 5-second about room even if it uses the power source of which frequency, the defect of electronic parts is considered in practice that you may think that it hardly generates on every frequency.

[0151]

[Table 3]

ダメージ発生率

処理方法	電源周波数	ダメージ発生率
従来処理	１３．５６ＭＨｚ	０．０２％
本発明	１０ＫＨｚ	１０％
本発明	１３．５６ＭＨｚ	０．００１％

When surface treatment of this invention is performed in the ambient atmosphere containing oxygen or hydrogen from the above experimental result, it turns out that the best result is obtained. However, though natural, if processing by oxygen is performed in these cases for a long time, the metal of a lead will oxidize and corrode, and since there is a possibility that the metal of a lead may hydrogenate and stiffen when hydrogen is used for a long time, it is necessary to manage processing conditions severely in fact.

[0152] Drawing 18 shows roughly the example of the equipment which can perform surface treatment by this invention in ILB (inner lead bonding) which connects electronic parts to a tape carrier. It **** and the surface treatment equipment 90 for carrying out surface treatment of the tape career 86 before a bonding area 88 in addition to the configuration of the common knowledge which it becomes from the reel 87 and the bonding area 88 which performs bonding to which this ILB equipment 85 sends out a tape career 86, and the machine reel 89 which contains the tape career 86 which ended bonding is arranged. A tape career 86 is conveyed by the motor 91, is guided at two or more guide idlers 92, is ****(ed), passes

surface-preparation equipment 90 and a bonding area 88 from a reel 87, and is sent to a machine reel 89. A bonding area 88 has the bonding tool 93 driven up and down in a pressurization cylinder so that it may be known well, carries out pressurization heating of the inner lead 96 which projects in the aperture of a tape career 86, and connects with the IC chip 95 positioned on the chip stage 94.

[0153] Surface treatment equipment 90 consists of the same configuration as the surface treatment equipment of drawing 1 mentioned above, for example, and carries out gas discharge under the pressure near the atmospheric pressure within the dielectric tubing 2 by impressing high-frequency voltage to the gas sent from the gas transfer unit 7 from a power source 15. Said gas containing the active species generated by discharge blows off from the gas port 9 of dielectric tubing 2 lower limit towards the tape career 86 located immediately caudad. By being exposed to said active species, the dirt of the organic substance and an inorganic substance is removed from the front face of an inner lead 96 and a tape career 86. Thereby, the junction nature of an inner lead 96 and the IC chip 95 improves sharply. In this case, if surface preparation of the plane of composition of the IC chip 95 is similarly carried out using separate surface-preparation equipment, both junction nature will improve further. Moreover, reforming of the front face of an inner lead 96 and a tape career 86 is carried out to coincidence by said surface treatment, and wettability improves. Therefore, in case the resin seal of these is carried out at a back process, adhesion with mold resin improves. Thereby, finally the yield of TCP (Tape Carrier Package) improves.

[0154] Moreover, the surface-preparation approach of this invention can be used for dry washing in manufacture of a liquid crystal display. The production process of a liquid crystal display is roughly divided into a pattern substrate making process, a cel making process, and the making process of a liquid crystal module in order of a process, as shown in drawing 19 . First, in a pattern substrate making process, after washing a transparent electrode substrate, patterning of a required electrode and the wiring is carried out using a well-known vacuum deposition method and a well-known CVD method, and a pattern substrate is formed. Next, in a cel making process, after washing said pattern substrate, the orientation film is formed, and after washing further, a liquid crystal cell is formed. A polarizing plate is stuck on said liquid crystal cell of a predetermined dimension, and a liquid crystal panel is formed. Finally, said liquid crystal panel which passed inspection connects IC chip and the mounting substrate for a drive, is assembled by the case in a module making process, and a liquid crystal display completes it.

[0155] In this example, surface treatment by plasma discharge of the bottom near [which was mentioned above] the atmospheric pressure is performed to the whole surface of a substrate in the washing process in a pattern substrate making process, and 2 times of the washing processes in a cel making process. Thereby, the dirt of the organic substance and an inorganic substance can be removed from a substrate front face, and wettability can be improved for a back process. According to this invention, since washing of the substrate by sheet processing is possible, especially about wettability, it does not need to be cautious of pot life like [in the case of batch processing], and a production control can be carried out the optimal in consideration of schedules, such as a next patterning process and an orientation film formation process, the location where each activity is done, the problem of conveyance between them, etc. Moreover, since the substrate after washing can be sent to a back process on real time, in-line-ization is easily realizable. Furthermore, some substrates can also be washed alternatively if needed.

[0156] Furthermore, surface treatment in the bottom near the atmospheric pressure by this invention is similarly performed as pretreatment of the process which sticks a polarizing plate on a liquid crystal cell front face. Thereby, it is simply high-speed and the organic substance, such as remnants of flux and a scribe, dirt of a fingerprint, etc. which adhered to the liquid crystal cell front face in the former process, and an inorganic substance can be removed by low cost. A possibility of the activity of dirt dropping by the conventional help becoming unnecessary by this, and being able to reduce time and effort and the processing times, and not damaging a liquid crystal cell front face physically, and air bubbles remaining between a liquid crystal cell and a polarizing plate, and producing display defects, such as a poor image, is certainly cancelable.

[0157] In the last module making process, the final inspection is conducted after case assembly, and when a defective is discovered by the semiconductor chip mounted in the liquid crystal panel, this is removed and it exchanges for the chip of an excellent article. For example, as for the liquid crystal panel 96 shown in drawing 20 , direct continuation of two or more semiconductor chips 98 for a drive is carried out to the glass side of a liquid crystal cell 97 by the so-called COG (chip on glass) method. According to this invention, only the semiconductor chip 99 of the discovered defective is removed by heating the joint, for example.

[0158] Next, before exchanging and mounting the semiconductor chip of an excellent article, the gas containing the active species by discharge under near the atmospheric pressure by this invention is alternatively exposed to the junction field

100, and surface treatment is performed. In this case, since it can avoid affecting other semiconductor chip 98 and its joint simply when the mask 103 which has the puncturing 102 corresponding to the junction field 100 is used between surface treatment equipment 101 and a liquid crystal cell 97, as shown in drawing 21 , it is convenient. Therefore, the conventional local processing needs to remove no semiconductor chips like difficult wet washing or various dry washing. When the invention-in-this-application person experimented, it did in this way, and the adhesives which remain after removing a defective 99 from the junction field 100, wax material, etc. were removed by carrying out surface treatment, without affecting the semiconductor chip of the excellent article carried in other parts etc. in any way. The wettability of the junction field 100 has been improved by coincidence and the semiconductor chip of an excellent article was able to be connected to it good. Moreover, in washing of a joint, although it was difficult to remove the alkali residue contained in a fingerprint only by said surface treatment, it has defecated completely by carrying out combining pure-water washing before surface treatment or to the back.

[0159] Furthermore, in this example, it could be made in-line using the surface-preparation equipment 101 of a gun type, and bonding equipment with a soaping machine was obtained by uniting this with the bonding equipment of a semiconductor chip. Moreover, this invention is applicable also like washing of a joint, adhesives, etc. in semiconductor devices, such as a printed circuit board in which it could apply similarly about the liquid crystal panel which connected the liquid crystal cell and the mounting substrate by approaches other than a COG method, and electronic parts were carried in addition to the liquid crystal panel, though natural.

[0160] Moreover, the surface treatment by this invention not only carries out surface treatment of the plane of composition of the semiconductor device explained in relation to the above-mentioned example etc., but it can use it for various applications. Especially, since the surface treatment equipment of this invention can be processed also to which field under moreover irrespective of the sense of processed material, it is applicable also to washing the mold for injection molding, inside various tank and equipments, etc.

[0161] The suitable example of a configuration of that an in process washes using the surface treatment equipment 104 of this invention in the condition [having equipped this injection molding machine with the metal mold 106 of an injection molding machine 105, CD La Stampa, etc.] is shown in drawing 22 . Surface treatment equipment 104 is attached at the tip of the arm 109 of the robot 108 with the surface

treatment section 107 of said gun type structure as shown in drawing 6 movable free on the spot. An arm 109 can be moved in the direction of a three dimension free. Moreover, like the example of drawing 7 , the surface treatment section 107 can prepare only a nozzle at arm 109 tip, and can also build a discharge section body in a robot 108.

[0162] In this example, it can wash automatically by directing predetermined actuation to the robot 108 beforehand, without moving the surface treatment section 107 and removing metal mold 106, said CD La Stampa, etc. from an injection molding machine 105. And even when it has the configuration with a complicated front face and the big irregularity of metal mold by sending the gas containing active species into a processed material front face compulsorily according to this invention, it can fully process in a short time. According to the experiment of an invention-in-this-application person, the polycarbonate of CD ingredient adhering to the front face of CD La Stampa could be easily washed in about 20 minutes, and it has processed by one about 10 times the high speed of this as compared with the case of the conventional vacuum processing. Moreover, the remarkable effectiveness that mold-releases characteristic also including said CD La Stampa improved sharply was acquired at the same time the ingredient of organic systems, such as adhesives which adhered on the surface of metal mold, was also easily removable.

[0163] As mentioned above, although the suitable example of this invention was explained to the detail, this invention can add and carry out various deformation and modification in the above-mentioned example within the technical limits. For example, dielectric tubing and its gas port can be designed in various configurations except cylindrical according to a service condition.

[0164]

[Effect of the Invention] Since this invention is constituted as mentioned above, it does so effectiveness which is indicated below.

[0165] Since that of simplifying the configuration of equipment and miniaturizing by constituting so that it may be indicated by claim 1 is made according to the surface treatment approach of this invention, while being able to reduce cost sharply, equipment is made movable, workability can be raised or in-line-izing and processing in a site can be attained easily. And since the gas which contains the active species by discharge under the pressure near the atmospheric pressure is irradiated, the damage to processed material is lessened, high-speed processing is possible and improvement in wettability, etching, ashing, and various surface treatment of dry washing can be effectively performed in the field of the large range according to the

gas used irrespective of the configuration and the quality of the material of processed material.

[0166] According to the surface treatment equipment of this invention, and by [according to claim 23] constituting like By being able to realize the surface treatment approach mentioned above, being able to offer the movable equipment which can work like the so-called gun type by miniaturization further on the spot, and considering as the structure which moreover does not put an electrode to discharge Consumption of an electrode can be lessened, and the endurance of the whole equipment can be raised, and the damage to processed material can be lessened more.

[0167] Moreover, since according to the manufacture approach of the semiconductor device of this invention equipment can be miniaturize, and cost can be reduce, since a reduced pressure environment be need, and surface treatment can be carry out at high speed by discharge of the bottom near the atmospheric pressure, an electron and ion decrease as compared with an excitation kind, there be few electronic parts or damages to a lead, sheet processing be possible, and in-line-ization with the process which carry out the resin seal of the process or these which join RIDOTO to electronic parts can be attain easily.

[0168] Furthermore, since it is necessary to remove no electronic parts like before and processing can moreover carry out easily at high speed even when a part of electronic parts of a defective exist by constituting so that it may be indicated by claim 49 according to the manufacture approach of the semiconductor device of this invention, a man day and time and effort can be reduced sharply, and cost can be reduced.

[0169] Moreover, while according to the manufacture approach of the liquid crystal module of this invention generating of poor pasting of the polarizing plate to a liquid crystal panel is canceled and raising the yield by constituting so that it may be indicated by claim 47, attachment of a polarizing plate can be made easy, without producing a physical damage in a liquid crystal panel, and improvement in productivity can be aimed at.

[0170] Furthermore, since a liquid crystal panel can be washed by the high throughput by constituting so that it may be indicated by claim 48 according to the manufacture approach of the liquid crystal module of this invention, sheet processing is possible, a generous production control can be performed, without being greatly restricted to the pot life after processing, and in-line-ization with a back process can be attained.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing-of-longitudinal-section and drawing 1 B which shows the 1st example of surface treatment equipment according [drawing 1 A] to this invention is a sectional view in the B-B line.

[Drawing 2] It is drawing of longitudinal section showing the modification of the example shown in drawing 1 .

[Drawing 3] Drawing of longitudinal section in which drawing 3 A shows the 2nd example of surface treatment equipment, and drawing 3 B are the sectional views in the B-B line.

[Drawing 4] It is drawing of longitudinal section showing the 3rd example of surface treatment equipment.

[Drawing 5] It is the sectional view which consists of drawing 5 A thru/or drawing 5 C which shows the example from which the electrode structure of an inductive discharge mold differs, respectively.

[Drawing 6] It is the perspective view showing the so-called surface treatment equipment of the gun type by this invention.

[Drawing 7] Drawing 7 A is the partial cross-section perspective view showing the configuration of the surface treatment equipment which made the discharge generating section and a nozzle separate, and drawing 7 B is drawing showing the modification of a nozzle part.

[Drawing 8] It is the perspective view which ******(ed) the configuration of the Rhine type surface treatment equipment by this invention.

[Drawing 9] It is the perspective view showing another different example from drawing 8 of Rhine type surface treatment equipment.

[Drawing 10] It is the perspective view showing still more nearly another different example from drawing 8 of Rhine type surface treatment equipment.

[Drawing 11] It is the perspective view showing a gas passageway and another example of a configuration of an electrode.

[Drawing 12] It is the perspective view showing a gas passageway and still more nearly another example of a configuration of an electrode.

[Drawing 13] It is the block diagram showing the configuration for including moisture in reactant gas.

[Drawing 14] It is the block diagram showing another different configuration from drawing 13 .

[Drawing 15] It is the block diagram showing still more nearly another different configuration from drawing 13 .

[Drawing 16] It is the enlarged drawing showing signs that use the surface treatment equipment of drawing 1 and surface treatment of the electronic parts and the lead which were joined is carried out before a resin seal.

[Drawing 17] It is the sectional view showing the electronic parts and the lead by which the resin seal was carried out.

[Drawing 18] It is the block diagram showing roughly the equipment for carrying out inner bonding of the electronic parts to a tape carrier using the surface-preparation equipment by this invention.

[Drawing 19] It is the flow Fig. showing the process which manufactures a liquid crystal display.

[Drawing 20] It is a top view for explaining the point which removes the electronic parts of a defective from a liquid crystal cell.

[Drawing 21] It is the sectional view showing the liquid crystal cell partially washed using a mask.

[Drawing 22] It is the block diagram showing roughly the surface treatment equipment used for an injection molding machine and it, and one.

[Description of Notations]

1 Surface Treatment Equipment
2 Dielectric Tubing
3a, 3b RF electrode
4 Insulator
5 Metal Casing
6 Gas Inlet
7 Gas Transfer Unit
8 Flexible Tube
9 Gas Port
10 Metal Mesh
11 Processed Material
13 Coaxial Cable 1
14 Impedance-Matching Circuit 14
15 RF Generator
16 Screw Thread
17 Discharge Field
18 Gas -- Conduit

19 Metal Covering
20 Surface Treatment Equipment
21 Glass Tube
22 Inside Glass Tube
23 Outside Glass Tube
24 Annular Vacant Room
25 RF Electrode
26 Earth Electrode
27 Discharge Field
28 Discharge Tube
29 Gas Inlet
30 Coil Electrode
31 Gas Port
32 Discharge Field
33 Processor
34 Nozzle
35 Discharge Generating Section
36 Tip Opening
37 Discharge Generating Section
38 Nozzle Section
39 Flexible Tube
40 Surface Treatment Equipment
41 Body
42 Nozzle Section
43 Surface Treatment Equipment
44 Dielectric Plate
45 Gas Inlet
46 Gas Port
47 RF Electrode Plate
48 Insulator
49 Metal Covering
50 Inside Glass Plate
51 Outside Glass Plate
52 Gas Inlet
53 Gas Port
54 RF Electrode

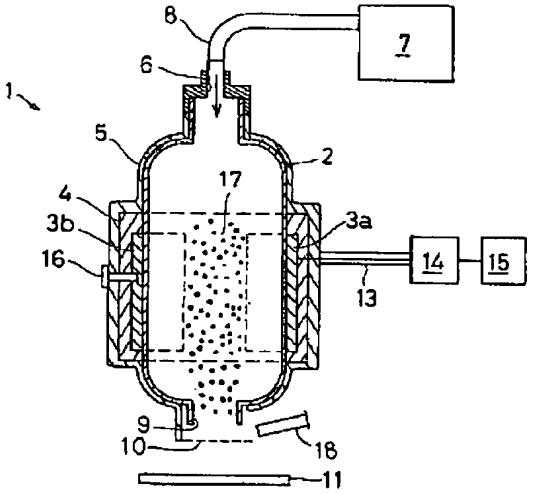
55 Electrode
56 Insulator
57 Metal Covering
58 Discharge Field
59 Outside Glass Plate
60 Gas Port
61 Electrode
62 Inside Glass Plate
63 Earth Electrode
64 Dielectric Plate
65 66 Electrode
67 Gas Passageway
68 Gas Port
69 70 Electrode
71 Surface Treatment Equipment
72 Pipe
73 Bulb
74 Tank
75 Pure Water
76 Heater
77 Atomizer
78 Pipe
79 Electronic Parts
80 Lead
81 Die Pad
82 Wire
83 Mold Resin
84 Package
85 ILB Equipment
86 Tape Career
87 it **** -- Reel
88 Bonding Area
89 Machine Reel
90 Surface Treatment Equipment
91 Motor
92 Guide Idler

93 Bonding Tool
94 Chip Stage
95 IC Chip
96 Inner Lead
97 Liquid Crystal Cell
98 Semiconductor Chip for Drive
99 Semiconductor Chip 99 of Defective
100 Junction Field
101 Surface Treatment Equipment
102 Puncturing
103 Mask
104 Surface Treatment Equipment
105 Injection Molding Machine
106 Metal Mold
107 Surface Treatment Section
108 Robot
109 Arm

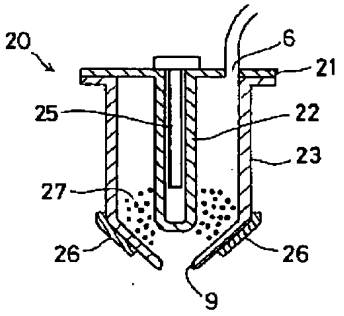
[Translation done.]

DRAWINGS

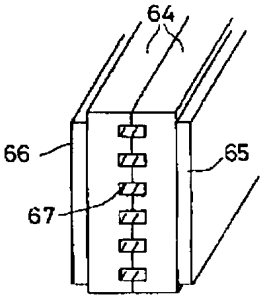
[Drawing 2]



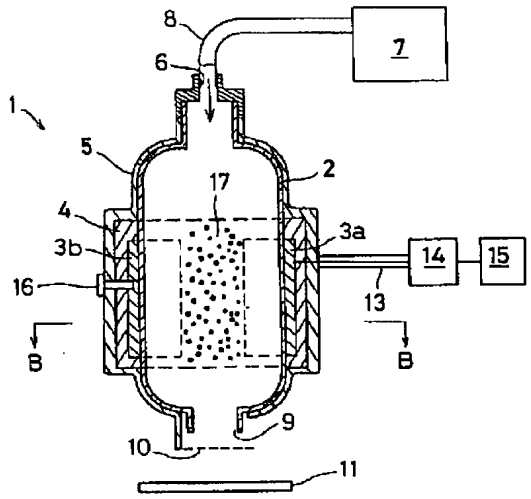
[Drawing 4]



[Drawing 11]



[Drawing 1]



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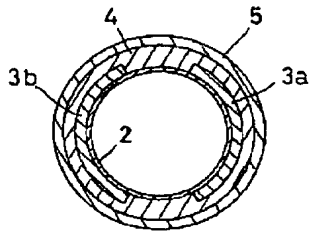

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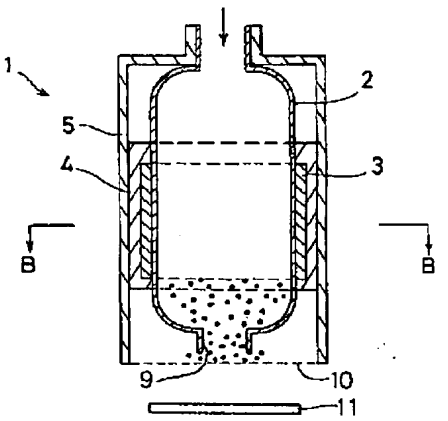
[Drawing 3]



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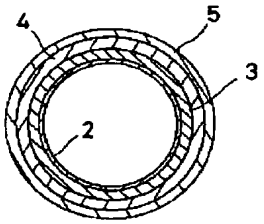

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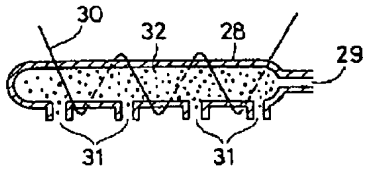
[Drawing 5]



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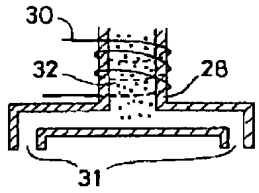

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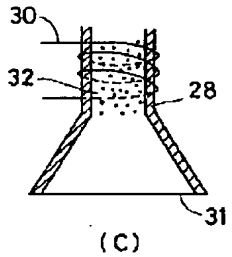
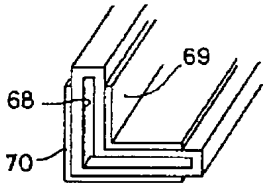
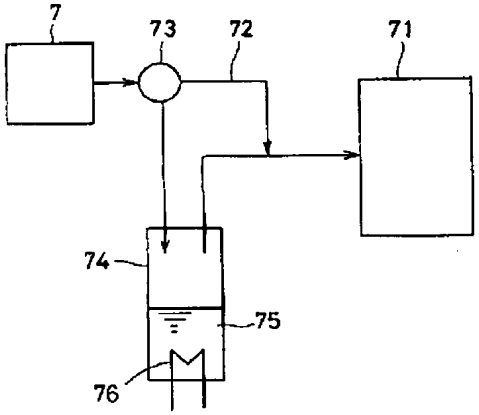


(C)

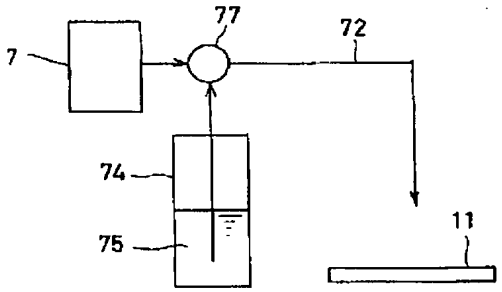
[Drawing 12]



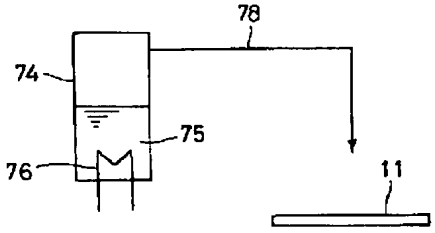
[Drawing 13]



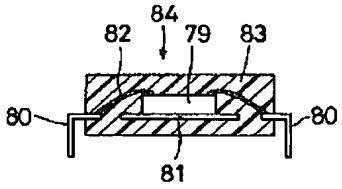
[Drawing 14]



[Drawing 15]



[Drawing 17]



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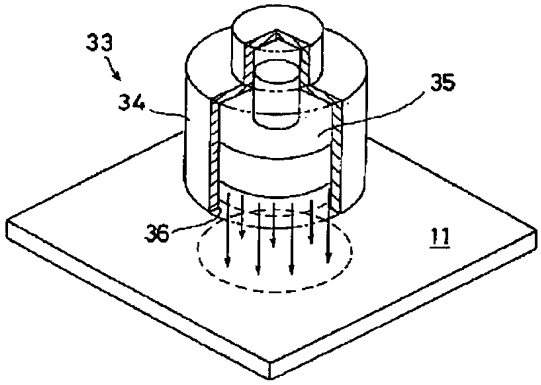
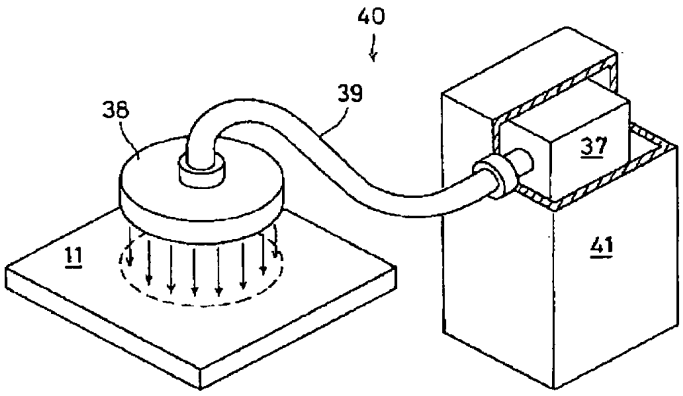


[Drawing 7]



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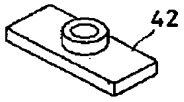

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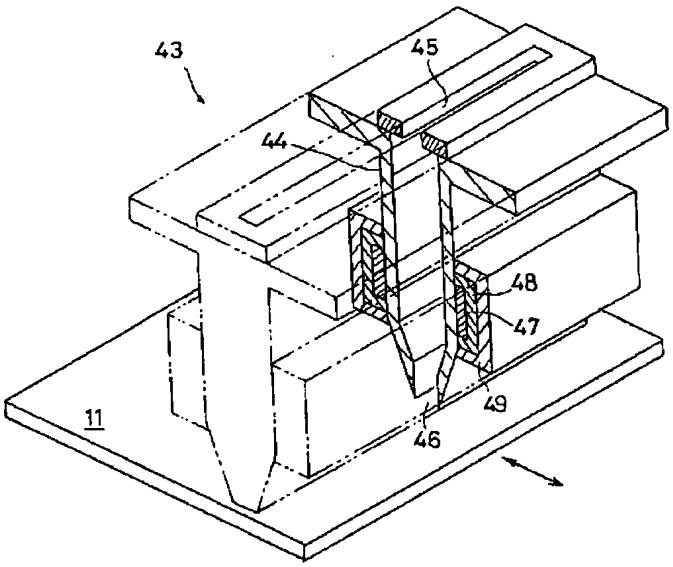
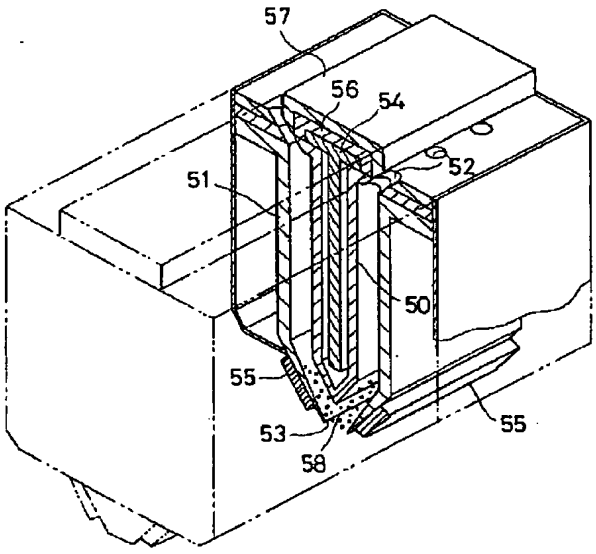
[Drawing 8]



[Drawing 9]



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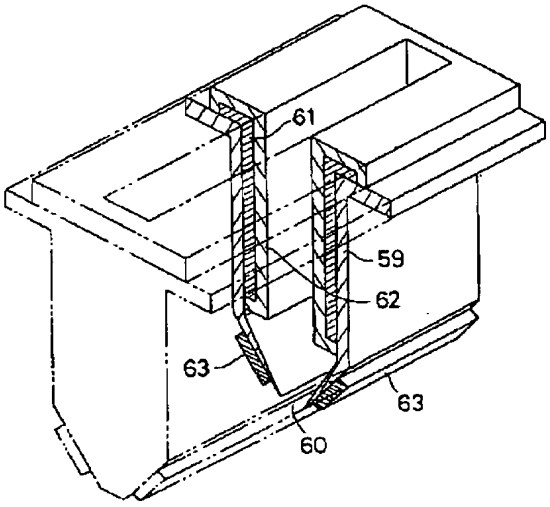
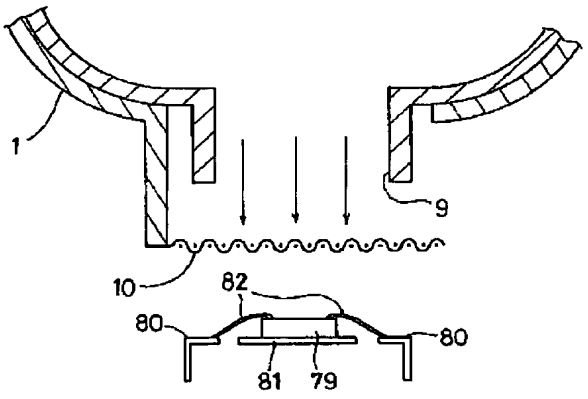


[Drawing 16]



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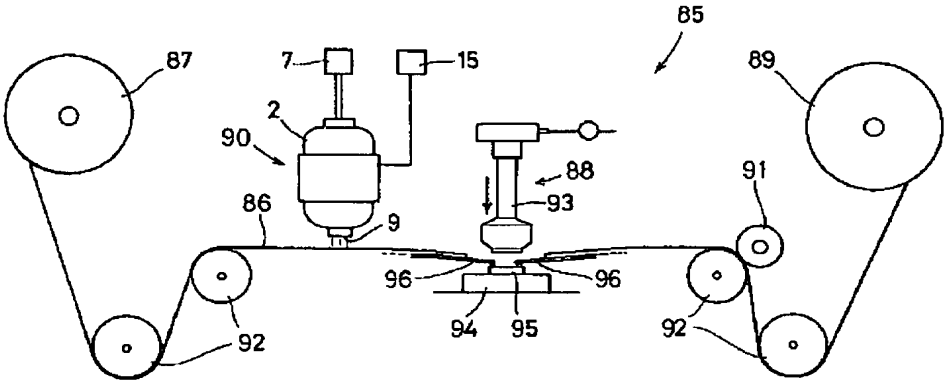
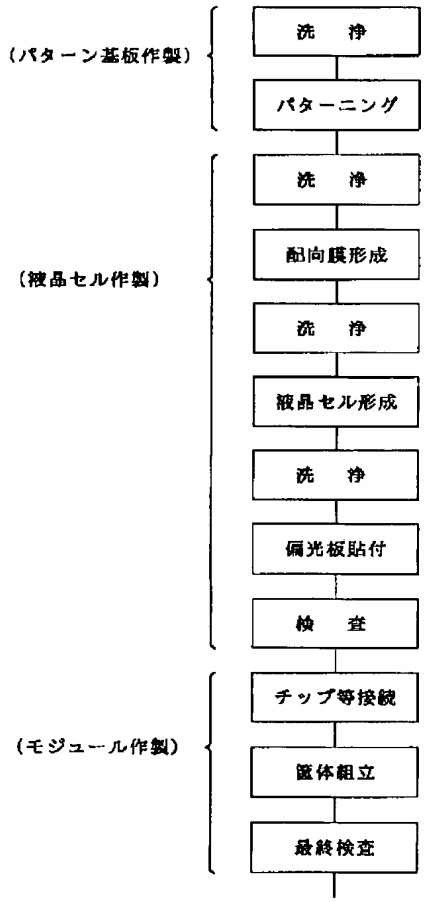
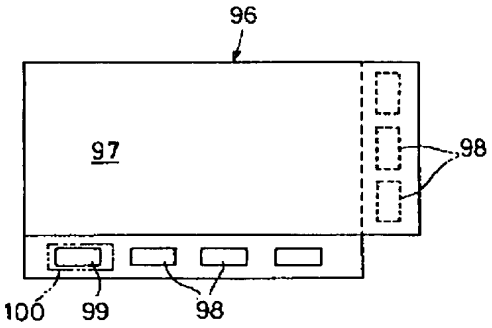


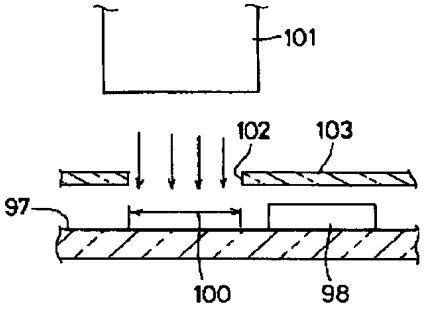
[Drawing 19]



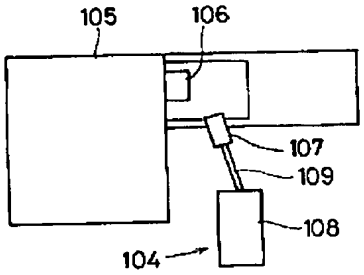
[Drawing 20]



[Drawing 21]



[Drawing 22]



[Translation done.]